

SCIENCE

A WEEKLY JOURNAL DEVOTED TO THE ADVANCEMENT OF SCIENCE, PUBLISHING THE
OFFICIAL NOTICES AND PROCEEDINGS OF THE AMERICAN ASSOCIATION
FOR THE ADVANCEMENT OF SCIENCE.

EDITORIAL COMMITTEE: S. NEWCOMB, Mathematics; R. S. WOODWARD, Mechanics; E. C. PICKERING, Astronomy; T. C. MENDENHALL, Physics; R. H. THURSTON, Engineering; IRA REMSEN, Chemistry; CHARLES D. WALCOTT, Geology; W. M. DAVIS, Physiography; HENRY F. OSBORN, Paleontology; W. K. BROOKS, C. HART MERRIAM, Zoology; S. H. SCUDDER, Entomology; C. E. BESSEY, N. L. BRITTON, Botany; C. S. MINOT, Embryology, Histology; H. P. BOWDITCH, Physiology; J. S. BILLINGS, Hygiene; WILLIAM H. WELCH, Pathology; J. McKEEN CATTELL, Psychology; J. W. POWELL, Anthropology.

FRIDAY, APRIL 4, 1902.

CONTENTS:

<i>The American Morphological Society:</i> DR. M. METCALF.....	521
<i>Twenty Years of Section H, Anthropology:</i> DR. GEORGE GRANT MACCURDY.....	532
<i>College Work for Agriculturists:</i> PROFESSOR R. H. THURSTON.....	534

Scientific Books:—

<i>Roozeboom on Die heterogenen Gleichgewichte, Ostwald's Analytic Chemistry:</i> PROFESSOR WILDER D. BANCROFT. <i>The Engineering Index:</i> PROFESSOR MANSFIELD MERRIMAN. <i>Sanderson on Insects Injurious to Staple Crops:</i> F. H. CHITTENDEN.....	537
<i>Scientific Journals and Articles.....</i>	541

Societies and Academies:—

<i>Science Club of the University of Wisconsin:</i> C. K. LEITH. <i>Philosophical Society of Washington:</i> CHARLES K. WEAD. <i>Anthropological Society of Washington:</i> WALTER HOUGH. <i>The Geological Society of Washington:</i> ALFRED H. BROOKS. <i>New York Academy of Sciences: Section of Anthropology and Psychology:</i> DR. R. S. WOODWORTH. <i>Section of Astronomy, Physics and Chemistry.</i> DR. F. L. TUFTS. <i>The Academy of Science of St. Louis:</i> PROFESSOR WILLIAM TRELEASE. <i>The Colorado Academy of Science:</i> WILL C. FERRIL. <i>The Elisha Mitchell Scientific Society:</i> PROFESSOR CHAS. BASKERVILLE. <i>New York Association of Biology Teachers:</i> G. W. HUNTER, JR.....	542
--	-----

Discussion and Correspondence:—

<i>Movements toward Union among Geographers:</i> DR. W J MCGEE. <i>Baldwin's Social and Ethical Interpretations:</i> DR. GUSTAVO TOSTI. <i>Carnegie Institution.....</i>	549
--	-----

Shorter Articles:—

<i>Discharge from Hot Platinum Wires:</i> PROFESSOR C. D. CHILD.....	553
--	-----

Paleontological Notes:—

<i>North American Elephantids:</i> F. A. L....	554
<i>Current Notes on Meteorology:—</i>	
<i>The Dust Storm of March 9-12, 1901;</i>	
<i>Meteorological Charts of the Great Lakes;</i>	
<i>The Seismograph as a Sensitive Barometer:</i>	
PROFESSOR R. DEC. WARD.....	555
<i>Scientific Notes and News.....</i>	557
<i>University and Educational News.....</i>	560

MSS. intended for publication and books, etc., intended for review should be sent to the responsible editor, Professor J. McKeen Cattell, Garrison-on-Hudson, N. Y.

AMERICAN MORPHOLOGICAL SOCIETY.

I.

At the annual meeting of the American Morphological Society, held at the University of Chicago December 31, 1901, and January 1 and 2, 1902, the following papers were presented:

The Physiological Zero and the Index of Development for the Egg of the Domestic Fowl, Gallus Domesticus: CHARLES LINCOLN EDWARDS.

From the study of 238 eggs distributed in 23 incubations of about six days each, and from the measurement of 59 unincubated eggs the following conclusions were derived:

1. The physiological zero, or the temperature below which there is no development, previously given by most authors at 28°, and by one at 25°, is established at the degree included between 20° and 21°.

2. The index of development is given for temperatures from 20°-21° to 30.75°.

The first phase shows a very gradual rise in the percentage of development of the embryo to 14 per cent. at 27° – 29° , the primitive streak alone showing. The second phase, beginning with notochord, neural plate and groove, and mesodermic somites, presents an abrupt rise to 54.83 per cent. of normal development at 30.75° .

3. The normal average diameter of the blastoderm of the unincubated egg, as determined from the measurement of fifty-nine individuals, is 4.41 mm. with a standard deviation of 0.4792 mm. and a coefficient of variability of 0.1087.

4. The normal average diameter of the area pellucida of the unincubated egg as determined from the measurement of fifty individuals is 2.51 mm. with a standard deviation of 0.3382 mm. and a coefficient of variability of 0.1347.

5. From 136 blastoderms in which primitive streaks have not developed, the form of the area pellucida is 59 $\frac{19}{34}$ per cent. round, 12 $\frac{1}{2}$ per cent. nearly round, 23 $\frac{9}{17}$ per cent. oblong and 4 $\frac{7}{17}$ per cent. oval.

6. The normal average volume of the egg, as determined from the measurement of 100 individuals, is 51.67 c.c., with a standard deviation of 4.8602 c.c. and a coefficient of variability of 0.0942. In 85 per cent. of fifteen unincubated eggs where the volume was noted the diameter of the blastoderm varies directly with the volume of the egg, but the variates are so evenly distributed about the average that the general averages of the measurements in this paper would not be especially affected by this element.

7. The introduction of successively higher stages, and the increased growth of blastoderms without primitive streaks as the temperature rises, together with a continued growth of the primitive streak with the non-appearance of other features of the embryo at a low temperature, 20° – 21° to 27° – 28° , would indicate a direct depend-

ence of ontogenetic organization upon warmth.

Differentiation without Cleavage in the Egg of the Annelid Chaetopterus pergamentaceus: FRANK R. LILLIE.

*This phenomenon was observed in both fertilized and unfertilized ova. The essential point is briefly this: That by the action of certain solutions the eggs are preserved alive, sometimes for as long as thirty-six to forty-eight hours, although neither cytoplasm nor nucleus divides. During this period the cytoplasm slowly passes through certain well-defined phases of differentiation, the yolk accumulating in a dense mass in the interior and the peripheral cytoplasm becoming vacuolated and ciliated. The ciliated ectoplasm and the yolk-laden endoplasm are analogous to the ectoderm and endoderm of the trochophore, and the phases of differentiation resemble some of the normal processes; though the resulting object can by no stretch of the term be properly called a trochophore.

The solutions employed were sea water with the addition of KCl or CaCl_2 , or both these salts. The eggs were left in the solutions for an hour and then transferred to sea water. If the solutions were above a certain density, the formation of the polar bodies was suppressed; but this did not interfere with the subsequent differentiation. During the period of time usually occupied by the cleavage the eggs were markedly amœboid; in some cases (especially after CaCl_2) throwing out a bewildering number and variety of long pseudopodia, and actually creeping like amœbæ. All intermediate conditions between this and actual cleavage were observed. During this period, in typical cases, the nucleus became enormously enlarged, and some chromatin was diffused through the cell. Fusion of ova frequently took place, and, in solutions containing CaCl_2 , large num-

bers frequently fused into a common mass. The nuclear conditions in these large fusion-masses offer an interesting object for study.

At the end of a period slightly longer than in the normal development the ectoplasm became vacuolated and ciliated. By the action of the cilia the eggs often rotated rapidly in the water. In the largest fusion-masses cilia appeared only on restricted areas.

Certain of the phenomena of ontogeny are thus shown to be independent of cell-division. It may be expected that further study of the material and careful analysis of the results will aid in the understanding of the mechanism of the earliest phenomena of development.

In conclusion, acknowledgment was made to the aid received from the subsequent work of A. D. Mead and Jacques Loeb.

The Rate of Growth in Marine Invertebrata: A. D. MEAD.

Ingestion and Digestion in Hydra: ELLIOT R. DOWNING.

Many observers have noted that the mouth of hydra is capable of great expansion, so that it can swallow comparatively large animals. The mouth is not a simple circular orifice; a cleft runs out from the center of the peristome toward each arm, so that it is divided into as many lobes as there are arms, the lobes alternating with the arms. The circumference of the expanded mouth is therefore as great as the contour of this radiate figure. These lobes at the margin of the peristome are double the thickness of the ordinary body wall on account of the greatly increased length of their endoderm cell. They become thinner toward the mouth and also where they merge into the body wall below the level of the tentacles. They are trav-

ersed by longitudinal muscle fibers continued from the body wall.

Ingestion is followed promptly by digestive processes. Within a few minutes after ingestion certain gland cells become apparent in the endoderm. These cells contain a nucleus which rapidly enlarges and becomes granular. As noted in the digestive processes of higher animals, these cells are probably forming enzymes. They rapidly decrease and finally disappear as the ferment is discharged into the body cavity. These gland cells stain best with gentian violet after osmic-Merkel.

The digestive process is rapid. Last June I observed a good-sized hydra ingest a young carp 8 mm. long. Seven hours later, as determined by sectioning, no trace of this remained in the digestive cavity. The digested material is absorbed by the endoderm cells, which after a meal are gorged with food spheres; much of this material, especially the oil, is passed on to the ectoderm cells, where it is stored. The fatty substance accumulated at the periphery of these cells forms a layer of droplets which may be stained an intense black by osmic acid. It is these fat droplets which during life give to hydra its brown color.

The History of the Eye of the Blind Fish Amblyopsis: CARL H. EIGENMANN.

The history of the eye of *Amblyopsis* may be divided into four periods:

(a) The first extends from the appearance of the eye till the embryo is 4.5 mm. long. This period is characterized by a normal palingenic development, except that cell division is retarded and there is very little growth.

(b) The second period extends till the fish is 10 mm. long. It is characterized by the direct development of the eye from the normal embryonic stage reached in the first period to the highest stage reached by the *Amblyopsis* eye.

(c) The third, from 10 mm. to about 80 or 100 mm. It is characterized by a number of changes which are positive as contrasted with degenerative. There are also distinct degenerative processes taking place during this period.

(d) The fourth, 80-100 mm. to death. It is characterized by degenerative processes only.

The eye of *Amblyopsis* appears at the same stage of growth as in normal fishes developing normal eyes. The eye grows but little after its appearance.

All the developmental processes are retarded and some of them give out prematurely. The most important, if the last, is the cell division and the accompanying growth that provide the material for the eye.

The lens appears at the normal time and in the normal way, but its cells never divide and never lose their embryonic character.

The lens is first to show degenerative steps and disappears entirely before the fish is 10 mm. long.

The optic nerve appears shortly before the fish reaches 5 mm. It does not increase in size with the growth of the fish and disappears in old age.

The scleral cartilages appear when the fish is 10 mm. long; they grow very slowly, possibly till old age.

There is no constant ratio between the extent and degree of ontogenic and phylogenetic degeneration.

The eye is approaching the vanishing point through the route indicated by the eye of *Troglichthys*.

There being no causes operative or inhibitive, either within the fish or in the environment, that are not also operative or inhibitive in *Chologaster agassizii* which lives in caves and develops well-formed eyes, it is evident that the causes controlling the development are hereditarily estab-

lished in the egg by an accumulation of such degenerative changes as are still notable in the later history of the eye of the adult.

The foundations of the eye are normally laid, but the superstructure, instead of continuing the plan with additional material, completes it out of the material provided for the foundations. The development of the foundation of the eye is phylogenic; the stages beyond the foundations are direct.

Asymmetry in the Rattulidæ, and the Biological Significance of Asymmetry in some Lower Organisms: H. S. JENNINGS.

The Rattulidæ are a family of Rotifera having an unsymmetrical form. The body presents the appearance of having been twisted, so that primitively dorsal structures are on the right side at the anterior end, and on the left side at the posterior end. An oblique ridge on the dorsal surface passes from the rear forward and to the right, ending frequently in one or two teeth on the right side. It was shown that this twisted form is an adaptation to the method of life and behavior of the animals; they swim in a spiral, of which the twisted body forms a segment, and the oblique ridge marks the course of the spiral. The reaction to stimuli is also correlated with this form. It was further pointed out that such an unsymmetrical form is common among small organisms which swim in a spiral course and react to stimuli in the characteristic manner described in the paper; this is true for example of most of the free-swimming Infusoria. If radial symmetry be considered characteristic of a fixed life, bilateral symmetry of an active life in which dorsal and ventral surfaces have different relations with the substratum, we may on similar grounds distinguish an unsymmetrical or spiral type,

characteristic of swimming organisms which follow a spiral path, keeping the same side of the body always directed toward the axis of the spiral. A large number of organisms show this type of structure.

*On the Early Development of *Spermophilus Tridecemlineatus*, a new Type of Mammalian Placentation:* THOMAS G. LEE.

Spermophilus differs from other rodents in a temporary fixation of the blastocyst to the antimesometrial wall of the uterine cavity. Later the blastocyst detaches and the true placenta develops on the mesometrial wall. The uterine lumen resembles a capital T, the cross-bar being the mesometrial side. Tubular glands open on all mucous surfaces, later disappearing in the antimesometrial region. The ovum, entering the uterine cavity at the close of segmentation, forms a small blastocyst consisting of an outer or trophoblast layer and an inner cell-mass, which differentiates into ectodermal and entodermal portions. At the antiembryonal pole of the trophoblast a multinucleated syncytial mass develops which projects from the free surface. This fixation mass perforates the uterine epithelium and touches the growing vascular connective tissue. Enlarging, it becomes a rounded mushroom-shaped mass, convex next the connective tissue, cupped next the blastocyst. The thin margins gradually extend between the epithelium and connective tissue. Later numerous root-like processes develop composed of fine longitudinally striated protoplasm; these extend into the connective tissue of the mucosa. The anti-mesometrial portion of the uterine cavity loses its epithelium and rapidly dilates to accommodate the growing blastocyst. The fixation mass becomes a more and more shallow cup and the roots atrophy and disappear; the result being the separa-

tion of the blastocyst from its attachment. By means of a zone of trophoblast external to the germinal area the embryonal pole of the blastocyst becomes attached to the margins of the transverse mesometrial portion of the uterine cavity which retains its epithelial lining and forms the site of the true placenta. Later development is similar to that of the European form, *Spermophilus citellus*, described by A. Fleischmann. A detailed description of these stages with plates and discussion of literature will soon be published.

*Demonstration of the Placentation of *Spermophilus* (stereopticon):* THOMAS G. LEE.

*Variation in the Box Elder Bug (*Leptocoris*):* H. B. WARD.

Some Alaskan Sipunculids: H. B. WARD.
Cell-Homology: EDMUND B. WILSON.

In an analysis of the conception of cell-homology, it was pointed out that here, as elsewhere, the essential criterion of genetic homology is that of common ancestral descent, and that no purely embryological criterion is in itself adequate. That cell-homologies may be merely incidental or secondary to regional homologies of the egg as a whole applies equally to all forms of genetic homology and constitutes no valid argument against cell-homology; but, owing to the plasticity of cleavage-forms, cell-homologies may be more readily modified or even obliterated than other forms of homology. For practical purposes cells of like prospective value, giving rise to homologous structures, may, irrespective of their origin, be called *equivalent*; those of like ontogenetic origin and position may, irrespective of their fate, be called *homoblastic*; but neither equivalent nor homoblastic cells are necessarily homologous. The term homology (partial or complete) is applicable in cleavages of like pattern which have been derived from a common ancestral

type, and in which the corresponding cells are both homoblastic and equivalent. When the cells, though homoblastic, wholly change their equivalence, or when the cleavage-pattern itself wholly changes, the original homology disappears.

Degeneration in Paramæcium and so-called 'Rejuvenescence' without Conjugation:
GARY N. CALKINS.

Two individuals, A and B, of *Paramæcium caudatum*, from different sources, were isolated February 1, 1901. These were fed on twenty-four-hour hay-infusion and the number of divisions recorded at periods of from one to three days throughout the year, one individual being isolated each time. At the present time (December 30) A is in the four hundredth and B the three hundred and sixtieth generation, and no conjugation has taken place in the direct line of my cultures. Thus far the experiments have yielded the following results:

1. *Paramæcium* unquestionably passes through more or less regular cycles of activity and weakness.

2. The period of weakness is preceded by one of greater dividing activity.

3. The period of weakness ends in death, provided the diet (hay-infusion) remains the same.

4. Beef-extract restores the weakened functions of growth and division, without conjugation.

5. Normal conjugation between A and B, if followed by the same diet (hay-infusion), does not restore these weakened activities, but is soon followed by death.

6. Exogamous conjugation between wild gametes, and followed by hay-infusion diet, results in normal growth, division and life.

7. Endogamous conjugation does not differ from exogamous conjugation. The ex-conjugants live and divide normally if fed for a time with beef-extract, but die if fed directly with hay-infusion.

8. One intracellular effect of beef-extract upon weakened *Paramæcium* is the formation of 'excretory granules.' Another is the disintegration of the macronucleus.

9. A few conclusions to be drawn are: (a) A change of diet is necessary for continued vital activities. (b) What we may call parthenogenesis, or the development of gametes without fertilization, may be induced by change of diet. (c) Conjugation by itself does not 'rejuvenate.' (d) Conjugation probably has some other significance than that usually accepted; what this significance may be is not indicated thus far by my experiments.

Note on Metamerism of the Vertebrate Head: W. A. LOCY.

The Median Bundle of the Olfactory Nerve in Elasmobranchs: W. A. LOCY.

Fertilization in the Pigeon's Egg: E. H. HARPER.

In the pigeon's egg, polyspermy has been found to occur normally. The supernumerary sperm nuclei migrate to the periphery of the germinal disc and give rise to an accessory cleavage. They differ from the cleavage nuclei in the fact that their rate of division is more rapid; in being surrounded by wide areas of liquefaction; in having a finer chromatin network and more slender and elongated chromosomes; and in possessing one-half the somatic number of chromosomes. In their later history as yolk nuclei they divide amitotically. Never more than one sperm nucleus conjugates with the egg nucleus.

In the earliest stage of the fertilized egg observed, the egg was within the mouth of the oviduct. The first polar spindle was present and was surrounded by many sperm nuclei. Spermatozoa penetrate the egg most readily within the region occupied by the germinal vesicle in the ovarian egg, and the pronuclear phenomena also occur about within the limits of this region.

In the first breaking down of the sperm head a number of chromatin vesicles are formed equal to the number of chromosomes in the sperm.

The polar bodies are formed about the time the egg enters the glandular portion of the oviduct. They lie between the vitelline membrane and the cytoplasm.

In cell division, cytoplasmic currents are present. These currents precede nuclear division, and outline the paths by which the daughter nuclei later migrate apart. They are not confined to the immediate neighborhood of the nuclei, but extend into the region of the future blastomeres.

The spindles and asters are very minute in comparison with the size of the blastomeres and the appearance and curved paths of the currents indicate that cytoplasmic division is due to amoeboid movements rather than to the tension of astral fibers.

The Development of Color in the Definitive Feather: R. M. STRONG.

The colors of feathers, as was pointed out by Bogdanow ('58), Gadow ('82) and others, are due to the presence of pigment or to special conditions of structure. The pigmentation of the feather takes place in the earlier stages of the development of the feather. The dark brown pigments, commonly classed as melanins, appear to be formed in the cytoplasm of epithelial cells which are differentiated to produce pigment. These pigment cells, or chromatophores, send out branched processes to those cells which are to form pigmented elements of the future feather. Pigment granules pass from these pigment-cell processes into the cells composing the feather fundament. The formation and the distribution of pigment cease before cornification has proceeded far. There is no redistribution of pigment after the feather is fully formed and has burst forth from the sheath enclosing the feather germ.

A New Type of Hyper-metamorphosis: JAMES G. NEEDHAM.

This paper will be published in *Psyche*.

An Experimental Study of Regulation in Stenostoma: C. M. CHILD.

When portions are removed from chains of *Stenostoma* regeneration is complete, provided the piece is not below a certain size. In addition to the regeneration, the piece becomes more slender and narrower, the change first appearing, except under certain conditions, at the posterior end and extending anteriorly until it includes the whole body. The piece does not acquire the same proportions as the original, but approaches them more or less closely.

To explain this change, it is necessary, first, to examine the methods of locomotion and the locomotor structures of *Stenostoma*. The animal, like other rhabdocoels, is covered with cilia which constitute the locomotor organs.

When undisturbed, *Stenostoma* shows a strong tendency to attach itself to the substratum. The attachment by the tail, which is used as a sucker, is especially frequent and the tail adheres more closely than any other part of the ventral surface.

Most of the time when the animal is attached the lateral and dorsal cilia are vibrating and are thus acting in opposition to the organs of attachment; the result is the subjection of the body to a certain amount of mechanical tension. That such tension does exist is evident from a large number of observations.

If we suppose the animal to be attached by the posterior end and the lateral and dorsal cilia vibrating with equal speed and force, the tension upon the tissue at any cross section of the body will be proportional to the number of cilia which are anterior to that cross section, *i. e.*, the ten-

sion will be greatest at the posterior end and null at the anterior end of the body, with a complete gradation between the two extremes.

The chains of *Stenostoma* always taper posteriorly, as would be expected if this tension is effective in modifying form.

The elongation and decrease in transverse diameter of pieces are exactly what might be expected if the tension is effective.

And, furthermore, it is possible to prevent the change of form (*morphallaxis*) by preventing the animals from attaching themselves. The form change occurs very rapidly in *Stenostoma*, being complete in twenty-four hours or less. Pieces were prevented from attaching themselves during twelve hours after operation and then were compared with pieces, originally of the same size, which had been allowed to attach themselves. The pieces which had not been allowed to attach themselves were little changed, while the controls had elongated in some cases nearly half of the original length and tapered strongly to the posterior end.

It was found also that the chains attach themselves more readily to rough than to smooth glass. A little very fine sand on the bottom of a glass vessel is sufficient to cause the animal to attach itself more readily and therefore to change its form more rapidly than a specimen kept in a clean glass jar.

In all these experiments the specimens were kept without food.

The experiments show that form-regulation (*morphallaxis*) in *Stenostoma* is, at least in large part, purely a mechanical phenomenon, not the effect of stimuli.

Cord and Brain: J. B. JOHNSTON.

Recent studies upon the brain and cranial nerves of lower vertebrates show that the nervous system, exclusive of the sympathetic and higher brain centers, falls into

four chief *functional divisions*. These are as follows:

A. Somatic sensory division: Consisting of the free nerve endings and sense organs (neuromasts) in the integument, exclusive of end buds; nerve components innervating these organs (dorsal roots, exclusive of sympathetic fibers, V., VIII. and lateral line roots); and the nerve centers in which these components end (dorsal horn, tuberculum acusticum and cerebellum). Its stimuli give rise to reflexes which affect the animal's relations to its environment, and in higher forms commonly give rise to sensations and conscious reactions.

B. Splanchnic sensory division: Free nerve endings in the lining of the alimentary canal, sense buds in the branchial and mouth cavities, and on the surface of the head and body (end buds); components innervating these (sympathetic fibers in the dorsal roots, X., IX. and VII. roots), and centers in which these components end (Clarke's column and lobus vagi or fasciculus communis with its nuclei). Its stimuli give rise to reflexes which serve the functions of nutrition, respiration, circulation, etc.

C. Somatic motor division: The ventral horn of the cord, the nuclei of the XII., VI., IV. and III. nerves, the somatic motor fasciculus and its 'tween brain nucleus, and the motor components innervating somatic musculature.

D. Splanchnic motor division: The region of the lateral horn in the cord, the nuclei of the X., IX., VII. and V. cranial nerves; and the motor components innervating splanchnic musculature.

In the parts of the brain rostral to the medulla the splanchnic sensory and motor divisions are wholly lacking, while the somatic motor extends forward nearly to the rostral end of the brain axis and the somatic sensory division includes the cerebellum and probably the tectum opticum.

Important parts of the mid, 'tween and fore brain (inferior lobes, central gray, striatum [?], etc.) belong to the same category as the tract and commissural cells of the medulla and cord. The nucleus of the posterior commissure and the olfactory apparatus cannot be compared with any structures in the cord or hind brain. There is no essential resemblance between the olfactory nerve and its central apparatus and the typical cranial nerves and their centers. The olfactory nerve has no segmental value.

The Development of the Postcaval Vein in Didelphys Virginiana: C. F. W. McCURE.

The variations in the mode of origin of the postcaval vein of the common opossum are so extreme as to preclude our formulating a typical arrangement for the species as a whole. The different modes of origin which characterize the postcaval vein in the adult are briefly as follows:

1. The postcaval vein may be formed through a union of the iliac veins which takes place *ventral* of the common iliac arteries (type I.);

2. Through a union of the iliac veins which takes place *dorsal* of the common iliac arteries (type II.); or,

3. Through a union of the iliac veins which takes place both *dorsal* and *ventral* of the arteries in question (type III.).

A study of the embryonic development of the posterior tributaries of the postcava shows, I think, how these variations have been derived. Embryos of 8.5, 12, 15 and 22 millimeters in length were examined.

In an embryo 8.5 millimeters in length the umbilical artery, on each side, *passed through a complete foramen* in the postcardinal vein, so that one portion of the circumarterial venous ring lay *ventral* and another *dorsal* of the artery. This foramen was situated near the point of union

of the external and internal iliac veins. In a subsequent stage the internal iliac veins approached each other in the median line and fused ventral of the caudal artery to form a common internal iliac vein.

The writer believes that the type of postcaval vein to be assumed by the adult depends upon the loss or persistence of those portions of the circumarterial venous rings which lie dorsal and ventral of the umbilical arteries.

If the atrophy affects the dorsal branches of the circumarterial venous rings, a postcava will result as in type I. If it is the ventral branches of the rings that atrophy, a postcava will result as in type II., but, if dorsal and ventral branches of the rings both persist, a postcava of type III. will be formed.

The Development of Pigmental Color in Insects: W. L. TOWER. (Read by title only.)

Progressive Variation in a Given Generation of some Plants and Animals: W. L. TOWER. (Read by title only.)

Observations on the Habits of Hyalella dentata Smith: SAMUEL J. HOLMES.

The observations on *Hyalella* that were made related to food habits, thigmotaxis, phototaxis, reactions to pressure and sexual habits. Experiments were performed with the end of determining the mode of sex recognition in *Hyalella*. That sight plays no important part in the process was proved by the fact that males whose eyes were blackened over with asphalt varnish succeeded as well as others in obtaining females. Neither did removal of the first and second pairs of antennæ in the males prevent their obtaining mates. It is therefore improbable that the males are guided to the females by the sense of smell. Several females, some of which were recently torn from males, were placed within a

small enclosure of fine wire gauze in a dish of water. Several males were placed in the dish outside the enclosure, but none of them paid the slightest attention to the females, although they seized the females quickly enough when the enclosure was raised and the females were allowed to scatter through the dish. It is only when the males accidentally collide with the females while swimming that any attempt is made to seize them. When a female collides with another amphipod she curls up and remains quiet for a time, when, if not seized, she soon passes on. When two males collide, each apparently attempts to seize the other and carry him about as a female would be carried. Males have the instinct to seize and carry about other amphipods they meet with, and are only prevented from so doing by the similar attempts of the other individual. Males which are mutilated by the removal of the large second pair of gnathopods, so that they are no longer able to make effective resistance, are seized and carried about by other males just as females would be carried. Sex recognition in this species is apparently determined by the different modes in which the two sexes react to the contact of other individuals.

Some Notes on Hybridism, Variation and Irregularities in the Division of the Germ-cell: MICHAEL F. GUYER.

At one stage in the maturation of germ-cells, preceding the true reduction division, bivalent chromosomes are formed ordinarily; that is, only half of the regular number of chromosomes appear, but each of the new chromosomes is apparently double and equivalent to two of the simple type. In the spermatogenesis of hybrids, the formation of the bivalent chromosomes is frequently incomplete or defective, so that the resulting divisions are irregular and unequal. The greater the difference between the two individuals crossed, the more

marked is the disturbance in the maturation of the germ-cells of the hybrid offspring. In a paper two years ago before a meeting of the Western Naturalists (abstract, SCIENCE, February 16, 1900), I discussed this point in the case of hybrid pigeons and I suggested that these peculiarities in chromosome formation might point to a tendency in the chromatin of each parent species to retain its individuality, and that the extreme variability seen in the offspring of fertile hybrids was possibly to be attributed to this variability in chromatin distribution. In hybrid plants (cannas) I have since determined that practically the same irregularities occur, and, recently, Juel described abnormalities in the germ-cells of hybrid plants which are in nearly every respect parallel to those which I found in the pigeon; hence it seems to me that the same possible interpretation presents itself. Moreover, perhaps the same conception will hold in the case of the many plants, such as the geranium or apple, which will not come true from seed, but require propagation by means of slips or grafts.

To test this I have recently undertaken a study of the formation of the pollen grains in the geranium and I find that in it, as in hybrids, irregularities in the first division of the pollen mother-cell frequently occur, though in a less degree. In answer to the question as to why a plant will come true from a graft or slip and not from seed, it seems possible that we may have a clue in this apparent inability of the chromosomes to fuse normally to form the bivalent type of chromosome. In hybrids it would seem that the chromosomes from each parent lie side by side and divide in an ordinary manner to construct and maintain the body, but that when the germ-cells are to be matured the usual doubling of chromosomes which occurs at such times is incomplete, the result being that the chromatin is un-

equally distributed to the later cells. In a less degree, the same thing occurs in the pollen cells of such plants as the geranium. No fusion of the chromosomes is necessitated in the slip; hence, they continue to lie side by side and divide in the ordinary way, and the new plant is practically a continuation of the old one.

Relative Variability of Pectens from the East and West Coasts of the United States: C. B. DAVENPORT.

Pecten irradians from Tampa, Florida, and *Pecten ventricosus* from San Diego, California, are closely related species, as the parallelism in color and markings indicates. They are a pair of species that, taken by themselves, favor the view of a recent connection of the Gulf of Mexico and the Pacific Ocean. In respect to the symmetry of the valve and in respect to the globosity (height divided by length), the San Diego form is much the more variable, as measurements and calculations of the index of variability of ten hundred shells prove. This greater variability of the Pacific form is a fact in agreement with what Eigenmann has found for fishes. It is correlated with the greater physiographic changes in recent times in the character of the shore line of southern California as contrasted with Florida.

An Experimental Study of the Development of the Lateral Line in the Frog Embryo: R. G. HARRISON.

The Ovary and the Reproductive Period: F. H. HERRICK.

Whenever it is impossible or impracticable to determine the reproductive periods of an animal by watching its behavior, the structure of the ovary will usually furnish the clue. This is true of the Crustacea, and probably of all other animals.

My present object is not only to illustrate this fact, but also to settle definitely the

spawning habits of the American lobster, concerning which doubt and disagreement still abound. To put the specific question briefly: How often does an adult female lobster lay her eggs? The answer is, every two years, as a rule. This same conclusion was reached six years ago, chiefly from a study of the comparative anatomy of the ovary of animals captured at different seasons, and while confident of its general accuracy at that time, it is now possible to supplement it with observations upon the living animals themselves.

In a single generation of ovarian eggs three stages may be conveniently chosen for special study: (1) The initial stage, when the ova of the preceding generation are laid; (2) the intermediate stage, when those eggs are hatched; and (3) the final stage, when the ovarian eggs have reached their full size and are ready to be expelled from the body. The average size attained by the ova at these successive periods can be determined with sufficient accuracy. The time interval between stages 1 and 2 is known to be approximately one year. The ratio of growth between stages 1 and 2 is approximately equal to the ratio of the volume of the laid egg and that of ova in the second stage, from which it follows that the time interval between stages 2 and 3 is also one year. Further anatomical facts and experiments with living animals also confirm this conclusion.

The adult spawning lobster therefore does not lay her eggs each year, as some have maintained, but every other year, although this normal biennial period is likely to be shortened or lengthened in individual cases. The evidence on which these conclusions rest is ample, and will be given in detail at a later time.

M. M. METCALF,
Secretary.

[To be continued.]

TWENTY YEARS OF SECTION H,
ANTHROPOLOGY.

THE American Association for the Advancement of Science very early manifested an interest in anthropology. In 1849, at the second meeting of the Association, Professor S. S. Haldeman read a paper entitled 'Linguistic Ethnology.' Communications relating to anthropology were presented at almost every meeting until 1869, when increasing interest in the subject led to the formation of a subsection of 'Ethnology' under the general section of natural history. In 1873, the name of the subsection was changed to 'Anthropology.' At the Buffalo Meeting in 1876, anthropology was recognized as a permanent subsection of natural history.

When the Association was finally divided into sections, as now constituted, Section H fell to anthropology. The first program of Section H was presented at Montreal in 1882, Professor Alexander Winchell presiding in the absence of Sir Daniel Wilson.

By a curious coincidence, Section H of the British Association for the Advancement of Science is also devoted to anthropology, and its first session was held in Montreal in 1884, two years after the initial meeting of our own Section H in that city. The story of the early struggles of anthropology for recognition in the British Association, as told by Sir William Flower,* is strikingly similar to that of its early struggles for recognition here.

Eighty-six papers on anthropological subjects were read prior to the organization of Section H in 1882. From 1882 to 1901, inclusive, the communications numbered 589, or an average of more than 29 per meeting. These figures refer only to the annual meetings, no records having been kept of the winter programs. The

* *Report of the British Association for the Advancement of Science*, 1894, p. 762.

maximum number of papers, 45, were presented at the Boston meeting of 1898, and the minimum number, 11, were presented at Montreal in 1882.

Judging from the nature of the communications, the interest of anthropologists has been somewhat unevenly divided among four general branches of anthropology, viz., archeology, ethnology, somatology and general anthropology. Archeology was the favorite subject prior to 1882, as it has been since.

The following tabulation is offered as a means of making a numerical comparison of the work done in the four general divisions of the subject:

	1849-1881	1882-1901	Totals
Archeology	48	261	309
Ethnology	22	211	233
Somatology	14	80	94
General Anthropology..	2	37	39
Totals	86	589	675

I have followed Brinton's* scheme of classification, grouping sociology, religion, mythology, linguistics and folk-lore under ethnology, and psychology under somatology.

In so far as the communications presented admit of geographical classification, it has been found that the members of the section have devoted themselves almost exclusively to the American continent. The reasons for such a choice are obvious. While science is supposed not to recognize political boundaries, problems that have a geographical basis go logically to resident workers, other things being equal. Legislation has also come to favor the home archeologist as opposed to the foreign. The study of anthropology naturally begins at home, a course always favored by questions of transportation.

* 'Proposed Classification and International Nomenclature of the Anthropologic Sciences,' *Proc. Amer. Assoc. for the Adv. of Science*, 1892.

Patriotism is a more or less constant factor in inspiring one with a love for everything pertaining to the home-land; archeology and ethnology, as well as form of government and commercial, artistic or literary supremacy. We cherish some relic of a vanished race all the more because it was found on the old homestead. Local, national, New World pride has evidently had much to do with our choice of subjects for special research. Add to all these considerations a vast and virgin continent awaiting the anthropologist, and there is little wonder he has given such a relatively small portion of his time to the Old World, or the islands of the sea.

Out of a total of 589 papers presented in the last twenty years only 32, or 5.4 per cent., were devoted solely to foreign lands, foreign being understood to mean all lands other than the American continent and immediately adjoining islands; while 39 papers, or 6.6 per cent., were comparative studies involving both American and other lands.

Of the vice-presidential addresses, four were on archeology, nine on ethnology, four on somatology and two on general anthropology. Eleven vice-presidents chose American subjects, eight chose comparative, and not one dealt with a purely foreign problem.

In order to determine the geographic distribution of subjects in Section H of the British Association, recourse was had to the 'Reports' covering the four years 1893-96. During that time, 136 papers (reports not included) were read, distributed geographically as follows:

Europe (including British Isles)	55, or 39.9 per cent.
Other lands	50, or 36.2 per cent.
Studies involving both Europe and other lands....	33, or 23.9 per cent.

Records of the anthropological section of the French Association for the Advance-

ment of Science during the same period, 1893-96, were analyzed with the following results:

Total number of papers read	116
Studies in Europe.....	86, or 74.2 per cent.
Studies in other lands....	21, or 18.1 per cent.
Studies involving both Europe and other lands....	9, or 7.7 per cent.

The German Anthropological Society may be considered as the equivalent of Section H in the British or American Association for the Advancement of Science. Applying the same geographical test to the work of the German Society of Anthropology as it appears in the *Berichte* for 1897-1900, inclusive, the results are as follows:

Total number of papers read. 88	
Studies in Europe.....	50, or 56.9 per cent.
Studies in other lands....	14, or 15.9 per cent.
Studies involving both Europe and other lands....	24, or 27.2 per cent.

To arrive at a juster comparison of the scope and trend of the work done in anthropology by the several associations, the same time unit should be used. This would call for the records of our sectional work from 1893 to 1896,* inclusive, instead of for the whole twenty years; and the records for these four years furnish the following data:

Total number of papers presented	136
Subjects pertaining to the Americas	105, or 77.3 per cent.
Subjects pertaining to other lands	7, or 5.1 per cent.
Subjects involving both the Americas and other lands	24, or 17.6 per cent.

The percentage of purely foreign studies is even lower for the short period of four years than for the long period of twenty years. On the other hand, there is a

* The German *Berichte* for 1897-1900 were selected because they were more accessible at the time of these investigations.

marked increase in the number of communications relating both to foreign lands and to the Americas.

The nature of the work under review is such as to render mathematical exactness impossible. I have endeavored to make the foregoing averages approximate the truth, and believe they can be relied upon to show that American anthropologists have been working in relatively greater isolation than have European anthropologists.

The cosmopolitan character of the programs of the several associations in question is found to be in direct ratio, not only to the area of the colonies and dependencies of the several countries, but also to the tonnage of their merchant marine engaged especially in the foreign trade. The anthropologist's horizon is constantly under limitations imposed by his government's colonial or commercial policy.

With colonies and protectorates beyond the confines of Europe aggregating over 11,000,000 square miles in extent, including India, and with a merchant marine engaged exclusively in the foreign trade, much larger than that of any other country (8,043,860 tons in 1899), open especially to them, the English anthropologists are brought into contact with foreign problems at so many points, it would be strange indeed did they not improve the opportunities thus afforded.

The colonies and dependencies of France cover an area (1901) of 3,740,000 square miles, with a population of 56,000,000. The area of German colonies and dependencies amounts to 1,027,120 square miles with a population of 14,687,000.

The United States became a 'world power' only three years ago. Enough time has not elapsed to show the influence of that step on the programs of Section H, but if we expand along with our opportuni-

ties, it is safe to say that an analysis of the work we shall do in the next twenty years will show different results from that of our record for the epoch just closed.

We may not be able to improve much on the quality or even the quantity, but, with an enlarged horizon, the work should become less and less local and fragmentary. I believe we are at the threshold of a new epoch in which the many interdependent and partially solved problems of the past shall be completed and thereby make possible vast progress in correlative and synthetic anthropology.

GEORGE GRANT MACCURDY.

NEW HAVEN, CONNECTICUT.

COLLEGE WORK FOR AGRICULTURISTS.

AUTHENTIC information regarding the progress made in the State of New York in the promotion of scientific methods in agriculture and the part taken by science and scientific men in their advancement has often been sought, and yet we rarely find a clear statement of the extensive work which has been done and is still being carried on in aid of scientific and intensive agriculture. The extent of this work is enormous and its value to the state is vastly more than proportionally valuable. It is mainly performed at the experiment station, and in the university extension work, of the College of Agriculture of the 'Land Grant College' of the state, at Ithaca, and at the experiment station at Geneva. A recent statement by the president of Cornell University is the first which has given us a concise, yet definite and satisfying, account of this work. We abstract the principal parts of this statement:

"By the Morrill Act of July 2, 1862, Congress enacted that there should be granted to the several states certain amounts of public land, from the sale of which there should be established a per-

petual fund, 'the interest of which shall be inviolably appropriated * * * to the endowment, support and maintenance of at least one college where the leading object shall be, *without excluding other scientific and classical studies and including military tactics, to teach such branches of learning as are related to agriculture and the mechanic arts.*' The provisions of this act were accepted by New York State; whereupon there was handed over to the State Comptroller New York's share of the congressional land script. The State legislature then passed an act (April 27, 1865) establishing Cornell University and appropriating to it the income from the sale of the script in the State's possession; and providing in the Charter of the University that 'the leading object of the corporation hereby created shall be to teach such branches of learning as are related to agriculture and the mechanic arts, including military tactics. * * * But such other branches of science and knowledge may be embraced in the plan of instruction and investigation pertaining to the University as the trustees may deem useful and proper.' The College Land Script Fund whose income was thus appropriated to Cornell University amounts to \$688,576.12. The State, as guardian of the fund, has turned it into the State treasury,—having issued to Cornell University a certificate of indebtedness on which it pays an annual interest at the rate of five per cent. amounting to \$34,428.80. This is applied to 'instruction in such branches as are related to agriculture and the mechanic arts, etc.'

"Some years later Congress saw that the provision made for the support of the colleges established under the Morrill Act of 1862 was not sufficient, and accordingly, by the second Morrill Act of August 30, 1890, it was enacted that there be 'appropriated to each state for the more complete

endowment and maintenance of colleges for the benefit of agriculture and the mechanic arts established under the provisions of the federal act of July 2, 1862, the sum of \$15,000,' to be annually increased by \$1,000 until the sum of \$25,000 was reached, 'and the amount thereafter to be paid to each state and territory shall be \$25,000 to be applied only to instruction *in agriculture, the mechanic arts, the English language and the various branches of mathematical, physical, natural and economic science*, with special reference to their application in the industries of life, and to the facilities for such instruction.' This congressional appropriation is now \$25,000 annually.

"There is therefore available for 'instruction in agriculture, the mechanic arts, the English language and the various branches of mathematical, physical, natural and economic science' \$59,428.80 received from the bounty of the United States. This is all that Cornell University receives from the federal government for any purpose. To prevent misapprehension I should perhaps add that the Federal Agricultural Experiment Station, for which there is an annual appropriation of \$13,500, is located at Cornell. But while the University lends its buildings and grounds and gives freely the services of its administrative officers for the conduct of the experiments and the management of the finances of the station, it gets no financial return, and not a cent of the Experiment Station funds can be used for purposes of instruction. * * *

"In return for the federal land grant, Cornell University gives free instruction, in all departments, to four students annually from each of the assembly districts of the State, making in all 600 free students annually.

"It gives free instruction also to all

agricultural students, of whom at present nearly 200 are enrolled. Thus Cornell University is a benefactor of the State of New York to the extent of conferring upon it annually free instruction for 800 students. On the average it costs a large and well-equipped university like Cornell about \$300 for the education of each student. *Cornell, therefore, annually gives to the people of the State of New York not much less than \$250,000.*

"The entire amount received from the United States—\$59,428.80 annually—does not begin to provide instruction even in 'such branches of learning as are related to agriculture' alone. * * * The total cost of maintaining the Agricultural College at Cornell University is found to be \$141,061.27.

"Towards the maintenance of this Agricultural College by Cornell University, the State of New York does not contribute. It appropriated, a few years ago, \$50,000 for a Dairy building, which was intended to form one wing of a great State Hall of Agriculture. But that hall remains unbuilt.

"I should mention the \$35,000 granted to the College of Agriculture by chapter 430 of the laws of 1899, which can be applied only to the special object for which it was granted, and that is the promotion of agricultural knowledge throughout the State by university extension methods. The College is happy to aid the State in so useful and helpful a work, but the College itself receives no benefit from it. For the sake of completeness I will add that the State maintains at Cornell University a New York State College of Forestry, for which it makes an annual appropriation of \$10,000, and a New York State College of Veterinary Medicine, for which it makes an annual appropriation of \$25,000. *No other appropriation of any kind, either for*

the University or for State institutions located here, is received by Cornell from the State of New York. All the rest of the revenues of the University is derived from private endowments. * * *

"Since the College of Agriculture was established it has given instruction to more than sixteen hundred students in residence at Ithaca, and it has become one of the foremost colleges of its kind in the United States. * * *

"There are in attendance at the present time some two hundred students in the various courses. Tuition is free in all courses. During the last five years there have been from ten to twenty graduate students in the University each year who have selected both their major and minor subjects or their major subject in the College of Agriculture. This indicates the opinion that students from other colleges have of the work being done here.

"In addition to the students in residence, we are teaching a vast number of students scattered throughout the State by means of correspondence courses. This work is for the promotion of agricultural knowledge throughout the State. There are enrolled in the Farmers' Reading Course department 30,000 students; in the Farmers' Wives' Reading Course, 8,000 students; in the Junior Naturalists' Club, about 30,000 pupils organized into 1,700 clubs; in the Home Nature Study Course, about 1,500 teachers. * * *

"Nearly five hundred farmers have conducted experiments on their own farms under the careful supervision of members of the teaching force. This is in addition to the investigations carried on at the University. There is scarcely a subject connected with fruit or field crops that has not been studied from close range in a majority of the counties of the State.

"I cannot state accurately how many

lectures before farmers' organizations have been delivered since the College was established, but they certainly number several thousand. In addition to all this, the College has done a vast work in helping the farmers out of their difficulties by personal correspondence. From five to ten thousand letters per year in answer to questions are written by the staff. This work alone is a great tax upon the College, but the benefits derived are so great that the practice still continues of answering, to the best of our ability, all questions related to agriculture, directly or remotely.

"The Experiment Station, a department of the College of Agriculture, has published 196 bulletins, in editions averaging more than 20,000 each, and fourteen annual reports. Whenever there is a serious outbreak of insects or fungi, a specialist is dispatched immediately to make investigations and to help overcome the difficulty. * * *

"Agricultural students have gone to all parts of the State and carried with them the light of science to aid the farmer in his arduous and difficult, though independent and noble, calling. Professors, by their investigations on the diseases that attack grains and fruits and flocks and herds, have saved millions of dollars to the State. The Cornell method of combating the pear-sylla saved over a million dollars to a single county. Methods of orcharding have added noticeably to the prosperity of farmers and fruit growers."

CORNELL UNIVERSITY. R. H. THURSTON.

SCIENTIFIC BOOKS.

Die heterogenen Gleichgewichte, vom Standpunkte der Phasenlehre. Erstes Heft: Die Phasenlehre: Systeme aus einer Komponente. By H. W. BAKHUIS ROOZEBOOM. Braunschweig, Friedrich Vieweg und Sohn. 1901. 14x22 cm. Pp. xiii+217. Price, paper, 5.50 Marks.

Every one who lectures on a subject feels the necessity of presenting it, so far as may be, in a systematic, coherent manner. For this reason we make the 'periodic law' the basis of lectures on inorganic chemistry, while we classify organic substances according to their constitution formulas. In physical chemistry the order of treatment has been based largely on the physical state of the system, gaseous, liquid or solid. It is an open question whether the orthodox classification is or is not the best in the case of inorganic and organic chemistry; but it is certainly not satisfactory for physical chemistry. The ideal classification for this last subject is based on the phase rule of Willard Gibbs and depends primarily on the number of components and secondarily on the degrees of freedom. By the components we mean the substances from which the system can be made, and we classify our material first as one-component, two-component, three-component systems, and so on, usually grouping systems containing more than three components under the single head of multi-component systems. We next subdivide each group according to the degrees of freedom, this depending on the relation between the number of independently variable components and the number of phases. By phases we mean the physically distinct portions of the system, such as the solution or liquid phase, the vapor phase, the solid phase or phases. When the only factors to be considered with relation to equilibrium are the pressure, temperature and the relative masses of the components, the state of the system is fixed when there are two more phases than there are components. Such a system is called an invariant system. When there is only one more phase than there are components, the system is called a univariant system, and it is said to have one degree of freedom because the state is not fixed until we settle arbitrarily the value of one of the independent variables. When the number of phases equals the number of components, the system is a divariant one having two degrees of freedom. Each decrease in the number of phases means an equal increase in the degrees of freedom.

The classification according to components and degrees of freedom is known as the phase-rule classification. It is broad enough to include all facts pertaining to equilibrium and yet clearly enough defined so that everything has its own place. It is therefore an ideal classification, or perhaps the ideal classification for chemical equilibrium. It is more comprehensive than the periodic law or constitution formulas, and chemistry as a whole will some day be presented from this point of view. The phase rule is to the science of chemistry what the steel frame is to a building, the periodic law, constitution formulas, the mass law, the laws of electrochemistry, etc., being the brick walls. Just as we can build a small building safely of bricks and wood, while the steel construction is the only wise one for a sky scraper, so we have managed to get along satisfactorily hitherto without the phase-rule classification; but the rapid development of quantitative chemistry necessitates a new arrangement.

The book by Professor Roozeboom does not claim to revolutionize chemistry in the manner just outlined. Our ignorance is still too great to permit such a scheme being carried through to-day, though the direction in which we are tending and must tend is very clear. This book deals chiefly with the qualitative side of equilibrium and this first volume with systems containing one component only. It is, however, a conscious and deliberate step in the direction of the goal I have indicated and no one is better qualified to take this step than Roozeboom. We owe the phase rule to Gibbs; but it was Roozeboom who brought out the significance of it; who changed it from an interesting but apparently unimportant mathematical generalization to the safe guide in all matters of equilibrium and to the future basis of systematic chemistry. In this first volume the author begins with the discussion of the boundary curves for liquid and vapor, solid and vapor, solid and liquid. The triple point at the intersection of these three curves is next considered. We then pass back to the equilibrium between two stable solid phases and to the triple point with solid, solid and vapor in equilibrium. A

chapter on flowing crystals follows, in which it is shown that these are properly to be considered as a solid phase and that the first inversion point is one for solid, solid and vapor. Next comes a chapter on instable triple points in the case of enantiotropic systems, and then one on the behavior of monotropic substances. The volume closes with a chapter on the triple point, solid, solid liquid; one on the triple point, solid, solid, solid; and a final chapter in which the general question of uniform and non-uniform pressure is considered.

WILDER D. BANCROFT.

Die wissenschaftlichen Grundlagen der analytischen Chemie, elementar dargestellt. Von W. OSTWALD. Dritte, vermehrte Auflage. Leipzig, Wilhelm Engelmann. 1901. 13x21 cm. Pp. xi+221. Price, bound, 7 Marks.

The book is divided into two nearly equal parts, the first containing general theory and the second the application. The first chapter deals with the conditions for recognizing a substance and might well have been fuller. When two or more properties of two substances coincide, the other properties usually do and the substances are identical. This is true, but not complete. For instance, the converse does not follow. We can have substances, notably some of the radio-active substances where certain properties can differ markedly and yet the two substances be the same from a chemical point of view. This raises the question as to what properties, if any, are to be considered fundamental.

The second chapter gives the methods of mechanical separation, together with the theory of washing a precipitate. The third chapter treats of separation by distillation or solution. The fourth chapter is devoted to the electrolytic dissociation theory and the fifth to the question of measurement. In the second portion of the book the author takes up the different elements in the usual analytical groups and discusses them. In an appendix are given a number of interesting lecture experiments.

The opinion one forms of this book will depend on one's point of view. If one looks upon it as a book for those beginning analyt-

ical chemistry, it is excellent because it contains many things which every one ought to know, and because one can justify many of the mistakes and omissions on the ground that the beginners should first get hold of the general outlines of the subject, leaving the troublesome exceptions until later.

If one looks upon the book as a work for analytical chemists, for men who know the practical details of their subject and who would like to get a broader and more general view of the theoretical side, the book is not up to standard. Such men will be annoyed by the quantitative application of the mass law to the solubility of strong electrolytes, by the tacit implication that nitrates are not soluble in nitric acid, by the assumption that continued addition of a salt with no common ion will cause continued increase of solubility, by the statement that ion reactions are necessarily more rapid than reactions where ions are supposed not to take part. If they have read the recent work of Kahlenberg on the action of hydrochloric acid on oleates in benzene solution, they may even ask themselves whether the electrolytic dissociation theory is necessary in order to account for results in aqueous solutions which are paralleled in solutions which do not conduct and where the electrolytic dissociation theory therefore does not apply.

WILDER D. BANCROFT.

The Engineering Index; Five Years, 1896-1900. Edited by HENRY HARRISON SUPLEE. New York and London, The Engineering Magazine. 1901. 8vo. Pp. 1030. Price, \$7.50.

The first and second volumes of this index to engineering literature, covering the years 1884-1895, were issued under the editorship of Professor J. B. Johnson from notes published monthly in the *Journal of the Association of Engineering Societies*. Since January 1, 1896, this work has been done by the *Engineering Magazine*, and the present third volume of the 'Index' is the gratifying result. It contains about a hundred pages more than the first and second volumes combined, while the amount of matter is more than twice as

much, owing to the arrangement of the page in two columns and to the smaller type. The number of periodicals indexed is about 350, nearly six times as great as in the second volume.

The index is a subject one, the titles of the articles or papers being classified under headings, each of which is subdivided into minor ones. For example, under 'Education' there are found twenty-one titles relating to engineering education in general, these being placed in alphabetic order according to the first word of the title; then follow about eighty special articles classified under sixty subdivisions, beginning with Admission Requirements and ending with Yorkshire College. Cross references are also given under both the general headings and their subdivisions, thus rendering it easy to follow special lines of inquiry in different directions. The styles of type used for the major and minor headings are good ones, although perhaps a little greater clearness might be secured with styles somewhat lighter.

The first volume of this series was called by Professor Johnson 'The Descriptive Index of Engineering Literature,' because there was added to the title of each paper a brief note giving an outline of its contents or an estimate of its value. While the name has unfortunately been changed, this excellent feature of descriptive notes has been retained, and these are of great assistance to the index searcher, for they usually give a clearer idea of the paper than can be obtained from its title. For example, under the heading 'Gas Engine' the title 'A Modern Motor' is somewhat vague, but the added note, 'The advantages of gas engines in points of economy, efficiency, cleanliness and safety,' immediately tells the reader whether or not the article is likely to be of value to him. In this volume the additional useful feature of noting the approximate number of words in each article has been introduced. The articles indexed from periodicals in foreign languages appear to be about ten or fifteen per cent. of the total number; the titles of these are given in English translation, followed by the original in parentheses.

For the use of the expert or specialist the index is not a complete one, as only the more important articles in the transactions of engineering societies are included. The oldest and most influential engineering society, the Institution of Civil Engineers of Great Britain, issues annually four volumes of proceedings, but these are not included in the list of periodicals indexed. Some important special German publications, like the *Zeitschrift für Vermessungswesen*, a high authority on geodesy and precise surveying, and *Baumaterialienkunde*, the leading journal on the testing of materials, are also not included. A few special American periodicals, like *Cement* and the *Metallographist*, are likewise omitted, but it is plain that it would be a difficult task to index all the literature of all the branches of the vast field of engineering.

Any index to literature should be prepared with the definite aim of being useful to a definite class of people. This has been done in the case of the present volume, the definite class being the readers of the *Engineering Magazine*, who include men of all professions having interest in transportation, manufacturing and construction. To these the index is admirably adapted, and it would be difficult to outline a plan that would produce better results for the engineering profession in general. The volume may appear somewhat incomplete to engineers who are experts in a special line like hydraulics, but when they turn to other headings they are likely to be astonished at the number of references and the number of periodicals that have been indexed. The expert may properly object to including titles of popular articles on engineering topics from the monthly literary magazines, but beyond this he has cause only for congratulation. The work has been carefully prepared on a comprehensive plan, and it should immediately find a place in every public library as a record of progress in the science and art of engineering, and in every technical library as an indispensable aid to research.

MANSFIELD MERRIMAN.

LEHIGH UNIVERSITY.

Insects Injurious to Staple Crops. By E. DWIGHT SANDERSON, B.S., Agr. New York, John Wiley & Sons. 1902.

Under the above title Professor Sanderson, entomologist of the Delaware Agricultural Experiment Station, has brought out a handbook of 295 pages, with 162 illustrations, the subject matter being disposed in 25 chapters. Besides topics of a general nature the following are discussed: 'Insects Injurious to Grains and Grasses,' 'to Wheat,' 'to Indian Corn,' 'to Stored Grain,' 'to Clover,' 'to Cotton,' 'to Tobacco,' 'to the Potato,' 'to the Sugar-beet,' and 'to the Hop-plant.' Although the author in his preface unreservedly disclaims any originality for the contents of his work, and states that, unless otherwise noted, all the facts are merely compilations of the writings of others, it is in some respects, in the writer's opinion, the most useful book covering the subject of the insect enemies to staple crops that is extant. The typography is excellent, and most of the illustrations are well produced. In its arrangement it is, in some respects, not unlike the 'Farmers' Bulletins' that have been published on entomology by the Division of Entomology of the U. S. Department of Agriculture; and the presented matter is grouped together in such manner that any one desiring information on any of the topics considered can find ready access to them.

The main incentive for the compilation of this work, as the author states, is due to the fact that our sources of information concerning injurious insects are so widely scattered throughout the circulars, bulletins and reports of the state agricultural experiment stations and of the U. S. Department of Agriculture, a few books on economic entomology and many other publications, that the farmer, provided he be not also an economic entomologist, is unable to obtain the facts which he desires concerning any given insect, unless it so happens that the species is treated in popular form in some publication from his own state. Again, most works upon American economic entomology give such meager descriptions and accounts of the life-histories of insects that the agriculturist cannot secure a clear

understanding of the subject in which he is interested.

The author might have gone farther in stating that many publications supposedly written in a popular manner—at least designed for distribution among the agricultural population—are so filled with technical terms as to render them unintelligible to the average reader. Many of the writers who publish in this manner fail to furnish summary accounts of what has been given in detail, and thus the reader is obliged to peruse many pages which have no interest to him in order to secure the object desired, which is usually an approximate knowledge of the appearance of the insect, the nature of its ravages, life-history, and, above all, the means for its reduction.

It might have been added that every year brings new pests to our shores, which in time become disseminated by flight and commerce through our country, and that this necessitates the publication of new popular works or of new editions of the old in order to consider these foreign pests and bring the works up to date.

In estimating the money value of the injury done by insects the author states that when we include that done to fruits, truck crops, domestic animals and timber, \$300,000,000 is a conservative estimate of the price these apparently insignificant creatures annually cost this country.

One good feature of the author's treatment of his subjects consists in the space given to the consideration of general farm practices that may be used in combating insect pests. In the treatment of this chapter he points out that few farmers in planning the management of their land for crops for the season consider the effect which any given procedure will have upon injurious insects with which they may have to contend. Farmers too frequently fail to look far ahead, and rotation of crops when practiced is more for the sake of soil improvement than for the reduction of insect attack, and yet crop rotation is the only remedy for many species of insects when they occur in injurious numbers over large areas, *e. g.*, in fields of grain. Among other

methods of tillage, clean farming, the destruction of weeds that might harbor injurious species, the burning over of fields after the crops have been made, fall plowing, drainage, the judicious use of fertilizers, the employment of trap crops, and the selection of the proper time for planting, are considered. Due attention is also given to the structure and development of insects, to beneficial insects, the value which accrues from the use of poultry as insect exterminators, and to insecticides, and the means for preparing and applying them.

Professor Sanderson's work is well fitted for the class of persons whom it is designed to reach, and it should have a large sale.

F. H. CHITTENDEN.

SCIENTIFIC JOURNALS AND ARTICLES.

THE *Journal of Comparative Neurology* for March contains two papers by J. E. Johnston on 'The Brain of *Petromyzon*,' and the 'Primitive Functional Divisions of the Nervous System.' The structure and connections of the nuclei of the cranial nerves in *Petromyzon* are closely similar to those of *Acipenser* previously described by the same author. Especially noteworthy is the presence of a large post-auditory lateral line root and a lobus lineæ lateralis corresponding to that of selachians and *Acipenser*. The fasciculus communis root of the facialis and the central relations of the sensory IX. and X. nerves are recognized and described for the first time. The cerebellum is in a very primitive condition histologically, the Purkinje cells being represented by simple large cells similar to those of the acusticum. In the forebrain the illusion of a well-developed cortex is due to the crowding and telescoping of the parts by pressure from the upper lip. The nuclei and fiber tracts are shown to be strictly comparable to those of the brain of other fishes. There is no cortex. The olfactory lobe contains a large number of slightly differentiated cells which serve as the end-nucleus of the olfactory nerve. In the second paper the author defines the longitudinal zones of the spinal cord and brain and the peripheral components and end-organs related to each.

The American Naturalist for March commences with observations on 'A Remarkable Occurrence of the Fly, *Bibio fraternus* Loen' by James G. Needham, the writer noting that several counts showed an average, on the ground, of 15 to a square foot, and that there were forty acres of *Bibio* territory. Even more remarkable was 'An Unusual Occurrence of *Dinoflagellata* on the California Coast' described by H. B. Torrey. The organism was a species of *Gonyaulax* and it caused the death of large numbers of fishes, holothurians and crustaceans, probably the putrefactive changes produced by the death of vast numbers of *Gonyaulax* itself. Annah Putnam Hazen describes 'Regeneration in *Hydractinia* and *Podocoryne*,' and James A. G. Rheen discusses 'The Standing of *Pteropus Haldemani* Hallowell' which he considers as a synonym of *Epomophorus gambianus* Ogilby. Finally there is a long and valuable article by John H. Lovell on 'The Colors of Northern Polypetalous Flowers' considered not only in their relation to insects but to the origin of the colors themselves.

The Popular Science Monthly for April opens with a discussion of the question 'Is this a Degenerate Age?' by J. J. Stevenson, who evidently considers that it is not. Frank H. Bigelow describes 'The Formation and Motions of Clouds,' showing the necessity for a study of the higher regions of the atmosphere in order to enhance the accuracy of weather forecasts, while under the title 'Contributions to Biology from Investigations on the Breeding Salmon' Yandell Henderson reviews the work of Miescher and gives some of the more important results of his observations. Frank Thilly discusses the question 'What is Philosophy?' and Edwin Grant Dexter presents 'A Study of Calms,' showing their apparent effect upon life phenomena. 'Our Foreign Commerce in 1901' is considered by Frederic Emory, showing what advances have been made in foreign trade and what may still be done in that direction, and Frank K. Cameron treats of 'The Soil as an Economic and Social Factor,' making a plea for more serious consideration of the subject. J. H. Gore tells of the proposed 'Draining of the

Zuider Zee' and David Starr Jordan of 'The Evolution of Fishes.' Finally we have some notes on Scientific Literature and the Progress of Science, the whole making an extremely good number.

SOCIETIES AND ACADEMIES.

THE SCIENCE CLUB OF THE UNIVERSITY OF WISCONSIN.

At the January meeting of the Club Dr. Victor Lenher described some curious results of an investigation of the telluride minerals. He has observed that when metallic tellurium and a gold solution are brought together, the gold is completely precipitated, while the replaced tellurium passes into solution. The natural tellurides of gold, when brought in contact with chloride of gold, precipitate gold from solution, and when only a little gold solution is used they completely bleach the yellow solution. Not only does this reaction show why gold is not infrequently found as a pseudomorph in the telluride localities, but it also casts considerable doubt on the true chemical character of the tellurides. As the fusion of gold with tellurium gives an alloy which precipitates gold from solution, this method of preparing an artificial telluride has been unsuccessful. Hydrogen telluride introduced into a gold solution was found to act as a reducing agent, precipitating pure gold containing no trace of tellurium. As sulphur chloride and nitric acid extract tellurium from these minerals, leaving noble metal as a residue, grave doubt seems to be cast as to these minerals being true chemical compounds.

On February 27 Professor Louis Kahlenberg lectured before the Club on the subject, 'Chemical Action and the Theory of Electrolytic Dissociation.' After a brief explanation of the theory of electrolytic dissociation, the lecturer stated that adherents of the theory have claimed that instantaneous chemical action, and even all chemical action, is due to the presence of free, charged ions, in other words, that instantaneous chemical changes take place only in conducting solutions. This claim is based on the fact that

aqueous solutions of acids, salts and bases are conductors of electricity, and that when such solutions are mixed, chemical changes occur in them instantly in most cases. In this connection a number of typical experiments of instantaneous precipitations by double decomposition in aqueous solutions were exhibited. Solutions of silver nitrate were treated with solutions of the chlorides of hydrogen, iron, sodium, potassium, etc.; in each case a white precipitate of silver chloride was instantly formed. Solution of copper nitrate in water was treated with hydrogen sulphide and copper sulphide was thrown down at once, etc.

The lecturer explained that such instantaneous chemical changes are, however, not at all confined to solutions that conduct electricity. Absolutely dry hydrogen chloride, ammonia, hydrogen sulphide, phosphorus trichloride, arsenic trichloride, antimony trichloride, tin tetrachloride and silicon tetrachloride, as well as the oleates of copper, nickel, iron and manganese, are soluble in hydrocarbons—benzine, for instance—and such solutions are most excellent insulators or non-conductors of electricity. These solutions have much the same outward appearance as conducting aqueous solutions. It was shown experimentally that when copper oleate solution in benzine is treated with the chlorides of hydrogen, phosphorus, arsenic, antimony, tin, or silicon, in the same solvent, there forms instantly in each case a heavy brown precipitate which is anhydrous cupric chloride. It is obvious that the formation of cupric chloride in these non-conducting solutions is perfectly analogous to the precipitation of silver chloride from the aqueous conducting solutions above mentioned.

Further instantaneous precipitations in these non-conducting hydrocarbon solutions were demonstrated experimentally, such as the formation of cupric sulphide, ammonium chloride, nickel chloride, cobalt chloride, etc. It was thus conclusively shown that instantaneous precipitations take place in non-conducting as well as in conducting solutions, and that the changes are perfectly alike in character. From this it follows that it cannot

be claimed that instantaneous chemical action takes place in conducting solutions *because* they are conductors, or, in the language of the dissociation theory, *because* they contain free, charged ions.

Molecular weight determinations of the sulphates of copper, iron, nickel, cobalt, etc., when dissolved in water, show that these salts are not dissociated; yet these solutions are good conductors of electricity. On the other hand, abnormally low molecular weights are observed in some solutions that are nevertheless non-conductors. Again, according to boiling-point determinations, common salt in water would be dissociated more in concentrated than in dilute solutions, which is absurd. It has further been demonstrated that solutions of acid sodium tartrate, as well as solutions of other acid salts, are far more sour to the taste and more toxic in their action toward plants than they ought to be according to the theory of electrolytic dissociation. From this array of facts, which has been published in a series of articles in the *Bulletin of the University of Wisconsin* and the *Journal of Physical Chemistry*, Professor Kahlenberg concludes that *the theory of electrolytic dissociation is untenable*.

At present scientists have no adequate explanation as to why certain solids—*e. g.*, metals—conduct electricity, and certain other solids—*e. g.*, wax or glass—do not. It is therefore not surprising that the real reason that some solutions conduct and others do not is yet unknown. A further careful, experimental study of solutions in various solvents will no doubt throw light upon this subject.

C. K. LEITH.

PHILOSOPHICAL SOCIETY OF WASHINGTON.

THE 548th regular meeting was held March 1, 1902.

Under informal communications several speakers described unusual appearances of rainbows, and Mr. Marcus Baker gave a brief statement of the present status of the Carnegie Institution.

The first regular paper was by Mr. D. L. Hazard, on 'The Secular Variation of the Magnetic Declination in the United States.'

This change in the direction of the compass needle appears to be of a periodic character, requiring several hundred years for its complete development and amounting in the compact part of the United States to 5° – 8° . The Coast and Geodetic Survey has followed up the phenomenon by observations for the past fifty years, and has now found it possible to deduce certain general relations between the geographic location of a place and the terms of the periodic formula representing the secular change in declination there. By means of these relations tables have been prepared giving the secular change in declination in each state and territory, and these tables were used in preparing the data for the isogonic chart of the United States for 1902 which has just been issued by the Coast and Geodetic Survey.

In the discussion that followed, Mr. Baker referred to the voluminous magnetic records of the General Land Office, discussed by Mr. Gannett. Mr. Bauer told of the expedition now in the field to locate the magnetic North Pole; and Mr. O. J. Klotz, of Ottawa, spoke of his own work based on the Canadian observations.

The next paper was by Mr. C. F. Marvin, of the Weather Bureau, on 'Anemometer Comparisons and the Use of Ball Bearings.' The methods employed in testing anemometers on whirling machines were described, and the advantages gained by making the tests in the open air during more or less windy weather pointed out. The artificial wind produced by the whirling-machine motion, combined with the natural wind, gives a resultant wind of a constantly changing velocity which resembles closely the gusty winds of nature. From the present state of knowledge of the Robinson anemometer problem, it appears that each type of anemometer requires to be investigated on its own merits. Anemometers of the same pattern, dimensions, construction and moment of inertia will agree within less than one per cent. In the standard Weather Bureau anemometer the old Robinson law that the cups move one third as fast as the wind is found to be true only for velocities between five and ten miles per hour. The

cup centers move relatively much faster at higher velocities. Thoroughly satisfactory tests have not been made at high velocities, but the indicated velocities of seventy-five to one hundred miles per hour obtained from time to time in gales and storms are undoubtedly too high.

The formula for the standard instruments is found to be $V = 0.263 + 2.953v - .0407v^2$; where v is the velocity of the center of the cups and V is the velocity of the wind, by observation up to about 35 miles per hour.

Speaking of the friction of anemometers it was stated that the popular impression that friction exerted an important influence on the indications of the anemometer was a mistake, and that it was easy to construct instruments even without ball bearings and keep them in such a condition that the friction was an unimportant factor in ordinary meteorological work. Friction is of importance only in the measurement of the most feeble air currents. These conclusions resulted from tests made with the whirling machine, and have recently been entirely confirmed by a six-month comparison of two standard Weather Bureau anemometers, exactly alike in all respects except that one instrument was fitted with ball bearings of approved construction, while the other instrument was an old one with the ordinary rubbing bearings. In a total run of 31,600 miles the ball-bearing anemometer gained 46 miles, viz., 0.15 per cent., on the anemometer with ordinary bearings. This slight difference was doubtless due quite as much to accidental causes as to the large difference in friction which was perfectly apparent to the ordinary perception.

CHARLES K. WEAD,
Secretary.

ANTHROPOLOGICAL SOCIETY OF WASHINGTON.

THE 327th meeting was held February 24. The Secretary to the Board of Managers announced the election to active membership of Dr. O. F. Cook and Lieut. W. E. Safford, U. S. N.

A Chilkat blanket loom with blanket in process of manufacture was exhibited by Dr.

Hough in the absence of Lieut. G. T. Emmons, U. S. N.

These blankets or fringed mantles of ceremonial character are invariably decorated with a symbolic design of the bear in yellow, blue, black and white. The loom consists of two uprights set in blocks, supporting a beam from which hang the unstretched warp threads of mountain sheep's wool twisted with bark fiber. The woof of dyed wool is twined by hand with the warp, the woman following a design drawn upon a board.

Dr. J. Walter Fewkes presented a communication entitled 'Sky God Personations in Hopi Worship.' Dr. Fewkes said that Hopi impersonations are made by means of masks, a dance with masks or by symbols as idols, pictures or images. The sky god is prominent in two great festivals, the dramatization of the return of the clan ancients or catchinas and their departure. In the former, he is a sun-sky-god personation called Ahuli, the 'returning one,' and in the latter Eototo, a god of growth, leads the ancients back. In the winter solstice ceremony the sky god is in form of a bird. The sky god is male and the earth god is female.

In discussing the paper Professor McGee said that man is constrained by custom more in uncivilized life. They personify certain potencies in common customs; later, these become ceremonies.

Dr. Fewkes' paper led the way to the discussion of the next topic, 'Animism, Totemism and Totemic Impersonations,' by Miss Alice C. Fletcher, Dr. A. E. Jenks, J. N. B. Hewitt, Francis LaFlesche and others. Miss Fletcher said that among the Sioux there is nothing answering to the sky god. The prominence of the sky god as a general term is rather fundamental. The Indian mind is like our own as to the beliefs; we are not yet free as to our minds. The conception of a god by the Indian would not be that of a single god, but dual, the union and manifestation of male and female principles.

Mr. Francis LaFlesche gave a legend of the Omaha and Osage, bearing on the origin of totems. When they were as one tribe they were very poor. They said 'No one can help

us but the magic power of Wakanda.' The children put clay on their faces and prayed to Wakanda. Then they got power to make bows and arrows and they blessed the bows and arrows, and in order to preserve the art they set apart a clan. They made houses, etc., and divided the families into clans. The buffalo, elk and turtle, for instance, are not worshipped as totem animals, but are a means through which Wakanda is worshipped. Mr. LaFlesche describes the way men get Wakanda. A hole in shape of a house is made in the ground beneath the grass roots, and the man stands before it and cries to Wakanda; he makes no definite petition, but cries for strength. Perhaps a wolf appears; it is a vision; he preserves that vision by killing a wolf, and takes the skin, or an ear, or tail, and this becomes his totem from Wakanda.

Mr. Hewitt spoke of the Iroquois god that holds up the sky. The legend relates that he was born from the armpit of his mother; he said he came from the sky. His brother is called 'Flint.' In the beginning animals were asked to support human beings, hence came totems. Personal totems originate in a dream at the age of puberty.

Miss Fletcher said in explanation that Wakanda is not seen, or felt, or heard and is only manifest through lesser powers.

WALTER HOUGH.

THE GEOLOGICAL SOCIETY OF WASHINGTON.

At the meeting of the Society on March 12 the first paper, by Mr. George I. Adams, was entitled 'Lithologic Phases of the Pennsylvanian and Permian of Kansas, Indian Territory and Oklahoma.' As stated by Mr. Adams, the succession of formations in Kansas, Indian Territory and Oklahoma, the lower of which are of Coal Measure or Pennsylvanian, and the upper of Permian age, forms an unbroken series. Within the area of their occurrence they exhibit several lithologic phases. The section in Kansas may be briefly described as: (1) Basal shales and sandstones with coal beds, (2) limestones interstratified with shales and some coal beds, (3) limestones interstratified with shales which carry no coal, and (4) shales which are

gypsiferous. In Indian Territory and Oklahoma the limestones thin out and disappear from the section approximately along the Arkansas River. The striking feature of the series south of the Arkansas is the transition of brown sandstones and carbonaceous shales with coal beds to red sandstones and shales. The line marking approximately the limit of the red color cuts diagonally across the stratification. The Red Beds, so-called, are accordingly equivalent in part to divisions 2, 3 and 4 of the Kansas section, with which they are in strike. Their lower portion is Coal Measure or Pennsylvanian in age, and the higher horizons in western Oklahoma are true Permian.

Mr. F. B. Weeks presented a paper on 'Gold-bearing Quartzites of Eastern Nevada.' In the Great Basin region the base of the sedimentaries is exposed in only a few localities. It consists of a coarse conglomerate of loosely cemented fragments of the underlying crystalline rocks, which passes rapidly into well-defined quartzites. These quartzites vary in thickness from a few hundred feet to twelve thousand feet, and are succeeded by a shale band carrying a Lower Cambrian fauna.

In many of the Great Basin ranges the lowest sedimentaries exposed are quartzites, having similar stratigraphic relations. They are usually light-colored, fine-grained rocks, and are known to be auriferous at a few localities. In these areas the strata have been faulted and crushed, and the series is composed of a succession of massive beds and of zones of crushed quartzites. No dikes or evidences of injection of vein material which affected the deposition of ore-bearing solutions have been found. At certain localities veins have been supposed to exist, but examination of the material in thin section reveals its quartzitic character. The pay ore is found in the zones of crushed quartzites and along fracture planes in the massive beds.

From well authenticated reports of assays of material derived from prospects in the massive beds, which had not been affected by faulting, it was found that these beds contain from five to ten dollars in gold. It was suggested that the zones of crushed quartzite had

been enriched by percolating waters which had derived their ore-bearing solutions from the overlying quartzite beds, and that in the latter the gold was probably associated with the sands on the sea beach from which these quartzites were formed, perhaps in the same manner as we find it in certain beach sands of the present day. It is desirable that data should be obtained to show how widespread is the occurrence of gold in the quartzites of this region.

A paper entitled 'Notes on a (Hitherto Undescribed) Meteorite from Admire, Kansas,' was presented by Mr. G. P. Merrill. The Kansas meteorite was described by Mr. Merrill as belonging to Brezina's *röckický* group, of which the meteorite of Eagle Station, Carroll County, Kentucky, is the only representative thus far found in America. The mineral composition was given as olivine, metallic iron, schreibersite, troilite, chromite and lawrencite.

The striking and most interesting feature of the stone as described was the pronounced brecciated structure, the olivines which occurred in single crystals and aggregates from one to thirty millimeters in diameter being almost universally fractured, and many of them in a decidedly angular condition. The metallic iron was described as occurring in the form of a binding constituent, the meteorite being therefore a breccia of olivine fragments with a metallic cement. It was noted that this metallic portion, however, occurred in two forms, the one compact and taking readily a high silvery polish, and the other less dense and dull gray.

Chemical analysis of the dull iron showed it to be not plessite, as ordinarily assumed, but a spongy mass consisting of metallic iron, troilite and lawrencite, or both; the lawrencite in such cases manifesting itself very quickly through oxidation and the exudation of a greenish iron chloride passing over rapidly into an oxide.

Starting out from the margin of these areas were acicular crystals, which it was assumed were incipient crystallizations of the metallic iron resulting from the reduction of the chloride. From the fact that the metallic por-

tions were found penetrating into the olivines and along the lines of fracture, it was also assumed that the iron was altogether secondary and posterior to the shattering of the silicate.

The meteorite will be described in detail in the *Proceedings of the U. S. National Museum*.

ALFRED H. BROOKS,
Secretary.

NEW YORK ACADEMY OF SCIENCES.

SECTION OF ANTHROPOLOGY AND PSYCHOLOGY.

A MEETING was held on February 28. Mr. J. H. Bair reported on some quantitative studies in sensory and motor association. His experiments have been carried out by aid of a typewriter, the subject reacting to different stimuli by striking different keys. Curves were presented showing the rate of formation of association. If, after the stimuli have been presented many times in the same order, the order is then changed, the association is interfered with, and the more so the firmer it has become. If the typewriter keys are interchanged, so that the reaction to each stimulus must be changed, this interferes still more with the association. These results showed, then, that the association of definite sense impressions with definite motor reactions was more persistent than the association of sense impressions with other sense impressions following in serial order, or than the association of movements with other movements following in serial order.

In the discussion of this paper, several other facts were mentioned, showing the importance of motor reactions in the formation of association. Professor Thorndike had observed that good visualizers, who are able to picture mentally a page of printed matter that they have read, yet cannot read off the pictured words; apparently because the visual images are not associated with motor responses.

Mr. J. B. Miner spoke on 'Involuntary Muscular Responses to Rhythmic Stimuli.' He described some experiments conducted by himself at Columbia and Minnesota universities, in which tracings were obtained for non-voluntary hand and head movements when the

subjects listened to a series of uniform sounds. It has been noted by Thaddeus L. Bolton and others in their investigation of rhythm that such a series of sounds appears not uniform, but as if coming in groups of two or more sounds. The muscle responses obtained correspond with this perception of rhythm, one wave coinciding with each rhythmic group. The movements recorded strikingly agree with another phenomenon of rhythm in that a motor wave shows for each stimulus when the sounds came slowly (forty per minute), but when the rapidity of the sounds was increased the wave encompassed two, three and even four sounds. This agrees with the introspective observation that the subjective group includes more units as the sounds come more rapidly. On the basis of the data of muscular responses Mr. Miner believes that an adequate physiological explanation of rhythm may be formulated, while organic rhythms alone would not furnish a completely correlated activity.

Dr. Clark Wissler reported some ergograph experiments showing that the contracting muscle presents a power series which is constant, whether the resistance is applied by a spring or by a weight. While this power series is weakened by fatigue, the resistance value of any point in the muscle series is the same for a weight or for a spring. In other words, there appears no difference between the fatigue produced by weights and springs when estimated in terms of the muscle series.

R. S. WOODWORTH,
Secretary.

SECTION OF ASTRONOMY, PHYSICS AND CHEMISTRY.

THE Section met at the Chemist Club on the evening of March 3. The first paper of the evening was by Mr. Charles C. Trowbridge, on the 'Physical Nature of Persistent Meteor Trains.' Mr. Trowbridge gave a list of forty meteor trains which had remained visible to the naked eye for from two minutes to more than one hour. The trains were all seen by reliable observers. Several tables were exhibited, giving the size, shape and color of recently observed meteor trains.

Mr. Trowbridge gave his views as to the most probable composition of meteor trains, and presented several hypotheses which might account for their long-continued luminosity. The hypotheses advanced were the following: (1) Incandescence of the particles of the train; (2) phosphorescence of the train; (3) electrical discharges; (4) reflection of the light from the sun, moon or stars by the particles of the train; (5) electrons striking the meteoric dust or the air particles in or about the train, causing a fluorescent glow similar to that in a Crookes tube. The source of the electrons may be either the highly heated meteor, in which case the long-continued luminosity of the train must be accounted for by a retardation of the fluorescence, possibly due to the low temperature, or the electrons may come from the sun; in this case the explanation would be similar to that lately given by Arrhenius for the light of the aurora. The author stated that this last hypothesis had not, so far as he knew, been previously advanced, and that the balance of evidence seemed to show that the luminosity of the persistent trains must be primarily caused by energy of an electrical nature. The subject is one of practical importance, owing to its bearing on meteorology.

The paper by Dr. S. C. Mitchell gave the results of observations on the flash spectrum taken by him at Sawah Loento, Sumatra, during the eclipse of May 18, 1901. Dr. Mitchell became, by the courtesy of the astronomical director of the Naval Observatory, a member of the eclipse expedition sent out by this government. The spectroscope employed was a Rowland objective plane grating of 15,000 lines, used in connection with a cœlostast. The weather experienced at Sawah Loento was like that at almost every astronomical location in Sumatra, cloudy throughout totality. However, through clouds, a spectrum of the flash at third contact was obtained which showed 374 bright lines between F and H. Investigations into the reasons for the differences of intensities in the flash and the Fraunhofer spectrum showed that the intensities depend on the heights to which the reversing layers of the different metallic elements

around the sun extend. It was found possible to arrange the elements in three groups according to their atomic weights.

Comparisons were made with Dr. Norman Lockyer's list of 'enhanced' lines, or those stronger in the spark than in the arc, in order, if possible, to confirm Lockyer's idea that the 'enhanced' lines play an important rôle in the chromosphere spectrum. Fifty-seven per cent. of the 'enhanced' lines of titanium were found in the flash, but at the same time all of these lines corresponded without exception to strong lines in the sun. On the other hand, so many cases were found where a strong 'enhanced' line was not matched in the sun by a strong Fraunhofer line, nor by any line in the flash spectrum, that it seemed that the measures did not support Lockyer's opinion.

Section adjourned.

F. L. TUFTS,
Secretary.

THE ACADEMY OF SCIENCE OF ST. LOUIS.

At the meeting of the Academy on the evening of March 3, about thirty-five persons present, Mr. L. T. Genung, of St. Louis, gave a general discussion of the Lepidoptera, their structural characteristics, habits and adaptations. He exhibited some of the more striking specimens of the Denton collection of butterflies, recently presented to the Academy of Science, and discussed the meaning of the various colors.

A paper by Mr. C. F. Baker, entitled 'A Revision of the Elephantopæ, I.,' was presented by title.

Two persons were elected to active membership.

WILLIAM TRELEASE,
Recording Secretary.

THE COLORADO ACADEMY OF SCIENCE.

At the annual meeting of the Academy, held February 11, 1902, in rooms of the State Historical and Natural History Society, State House, Denver, Colorado, officers were elected, and chairmen of sections appointed February 27, resulting in the selection of the following for the year 1902:

President, A. M. Collett; *First Vice-President*, Mrs. Cornelia Miles; *Second Vice-President*, Z. X.

Snyder; *Secretary and Treasurer*, Will. C. Ferril; *Executive Committee*, George L. Cannon, Ellsworth Bethel, Charles I. Hays, and *ex officio*, A. M. Collett and Will C. Ferril.

Sections and chairman of each, as follows: *Botany*, Ellsworth Bethel; *Zoology*, Alva H. Felger; *Geology*, George L. Cannon; *Microscopy*, Dr. J. B. Kinley; *Meteorology and Physical Science*, N. M. Fenneman; *Nature Study*, S. Arthur Johnson; *Anthropology and Ethnology*, Dr. A. L. Bennett.

The Colorado Academy of Science is limited in its membership to those of the State Historical and Natural History Society, who may be engaged in scientific work and study.

WILL. C. FERRIL,
Secretary.

THE ELISHA MITCHELL SCIENTIFIC SOCIETY.

THE 140th meeting of the Society was held on March 11 at the University of North Carolina.

The following papers were read:

'Enzymes': Dr. A. S. WHEELER.

'Reversible Action of Enzymes': Dr. R. H. WHITEHEAD.

'Molecular Attraction': Dr. J. E. MILLS.

CHAS. BASKERVILLE,
Secretary.

NEW YORK ASSOCIATION OF BIOLOGY TEACHERS.

THE first meeting for the current year of the New York Association of Biology Teachers was held at 43 Hancock Street, Brooklyn, N. Y., on January 31, 1902.

The following officers were elected for the year:

President, Dr. H. R. Linville, DeWitt Clinton High School; *Vice-President*, Dr. E. F. Byrnes, Girls' High School; *Secretary*, George W. Hunter, Jr., DeWitt Clinton High School; *Treasurer*, Miss M. F. Goddard, Peter Cooper High School.

Two papers were read, entitled, 'The Pedagogical and Ethical Content of Biology,' by Miss E. F. Byrnes, and 'The History of Zoology in the Secondary Schools of the United States,' by Miss Marion R. Brown, of the Erasmus Hall High School.

The purpose of the club is to discuss and, if possible, to determine, the best methods of teaching biology in the secondary schools. The club is now entering upon the third year

of a very successful existence with a much increased membership.

G. W. HUNTER, JR.,
Secretary.

DISCUSSION AND CORRESPONDENCE.

MOVEMENTS TOWARD UNION AMONG GEOGRAPHERS.

THE recent publication in SCIENCE of letters from Professor Russell, Professor Davis, and Mr. Stanley Brown recalls various other movements toward union among geographers. One of the earlier of these led to the founding of the American Geographical Society in New York; another to the institution of the National Geographic Society, with headquarters in Washington; others to the establishment of geographic clubs or societies in several centers; and still others to the enlargement of the geographic organization in Philadelphia first from a club to a society, then to a geographic institute. At least two of these organizations (those headquartered in New York and Washington, respectively) were originally designed to meet precisely such needs as those outlined by Professors Russell and Davis, together with the equally obvious need of diffusing the elements of geographic knowledge through public meetings and periodical publications; yet in both cases the latter function assumed such prominence as measurably to divert attention from the primary purpose. In both societies the modification in plan came about gradually—and it is probable that in both the changes grew out of the natural effort to balance income and expenditure in such wise as to please the majority of the members at each stage of progress. It is true, as the recent correspondents have pointed out, that the present organization of American geographers in a number of societies fails to meet all professional requirements; but it would seem to be an open question whether the needs might not be met more effectively and economically in some existing organization than by adding another to the already overwhelming list of American scientific societies.

Some of the events in the history of the National Geographic Society seem peculiarly

pertinent in this connection. The Society was founded in 1888, primarily to meet just such needs of working geographers as those felt to-day in Michigan and Harvard Universities; for a time the needs were met by meetings largely of technical character, and by a quarterly magazine devoted chiefly to technical papers; and in a somewhat later stage the magazine was reduced to a series of technical memoirs published in brochure form. During this early period various working geographers made important contributions to the science through this medium, technical papers by both Professor Davis and Professor Russell ranking high among these contributions. Gradually the interest of the meetings increased and extended to persons not engaged in geographic work, and to meet their desires the communications were made more popular; and about the same time the magazine was changed into a monthly of largely popular character. This transformation of the Society was never wholly acceptable to the working element, and various efforts were made to oppose it. Thus, early in the last decade, Dr. T. C. Mendenhall, then Superintendent of the U. S. Coast and Geodetic Survey and a member of the Society's board, led a movement toward creating a class of fellows designed to include the investigating and teaching geographers affiliated with the Society; the proposal passed the Board of Managers with only two dissenting votes, but failed of adoption by the Society at large. Thus again, in 1895, some of the working geographers of the Society undertook to establish a series of more technical papers complementary to the magazine, under the designation 'National Geographic Society Monographs'; of these one volume was published—at a financial loss so serious as to forbid continuance. Thus, too, repeated efforts have been made to bring working geographers together in different centers; a well-attended meeting, devoted primarily to technical papers and discussions, was held in Toronto in connection with the British Association for the Advancement of Science in 1897; another meeting was held in connection with the American Association and the Geological Society of America in Boston in 1898,

at which the papers and discussions were chiefly technical and the attendance and interest were fair; yet the experiments raised a question as to whether it is feasible for working geographers to assemble in summer when so many of their number are in the field. Despite these discouragements, working members of the Society have persisted in efforts to render the organization an appropriate nucleus for the geographers and geographic activity of the United States. As a step in this direction the Society was, during 1901, rendered national in character as well as in name by merging the classes of resident and non-resident members into the single class of members, and by providing that the Board of Managers shall be chosen from the entire country rather than from Washington alone. Some of the members, including the president, Dr. Alexander Graham Bell, urged that a class of scientific geographers, to be known as fellows, should be established in connection with this extension of membership. Dr. Bell's opinion on this subject appearing in several addresses before the Society; but the majority of the board were of opinion that the two propositions had better be kept separate. Accordingly, the modification of the constitution required for establishing a class of scientific geographers was not taken up last year, but is now pending, with every probability of favorable action. Connected with this change is a proposition to provide for technical publication in the form of a series of papers to be issued in brochure form, and to be known as 'National Geographic Society Memoirs.' Should the pending changes be made, the National Geographic Society will comprise: (1) A large and distinctly national membership (at present numbering about 2,500, distributed throughout all of the States and Territories) including nearly all of the working geographers of the country, (2) a distinctly national class of fellows designed to include all scientific geographers in the United States, and (3) a board of managers selected from all parts of the country, with only a sufficient number resident in Washington to meet convenience and legal requirements as to quorum, etc.; while its work will

be both scientific and popular, the former comprising (a) technical meetings in Washington and such other centers as may be desired, and (b) a technical publication distributed primarily among the fellows to serve as a record of original geographic work, and the latter comprising (a) popular lectures not only in Washington, but in other cities, and (b) an illustrated magazine of largely popular character, but designed to serve as a convenient medium for geographic publication. Should the plan for the technical memoirs fail of approval by the Society at large, the publication committee propose including the technical matter in the monthly magazine.

It is, perhaps, unfortunate that later developments in the National Geographic Society have not been more promptly and widely announced; yet it is by no means to be regretted that the delay has led to expressions from other quarters which seem to be precisely in line with the plans and policies of this organization.

W J MCGEE,

Vice-President National Geographic Society.

BALDWIN'S SOCIAL AND ETHICAL INTERPRETATIONS.

TO THE EDITOR OF SCIENCE: I have received, evidently in common with many other sociological *confrères*, a printed copy of a letter addressed by Professor Albion W. Small, of the University of Chicago, to both Professors Baldwin and Giddings. This publication gives renewed impetus to the unfortunate controversy raised by Professor Baldwin in an article published in the January number of the *Psychological Review*. May I be allowed to express, on the subject, the opinion of an outsider, which is also the opinion of the majority of workers who think that the advancement of social science is in no way promoted by such personal quarrels?

The facts of the case are known. In answer to a fair and, let me say, pertinent and conclusive criticism of his work on 'Social and Ethical Interpretations' by Professor Giddings, Professor Baldwin found no better answer than to cast upon his critic the reproach of 'poaching' upon his preserves. Professor Baldwin's answer was conceived in such

a way as to convey the impression that the word 'poaching' was simply a quotation from a review of Professor Giddings' 'Elements of Sociology,' previously published by Dr. Small. But the latter, besides showing that the word in question was contained only in a *private letter*, openly and frankly disclaims all responsibility for the construction placed upon it by Professor Baldwin, and clearly states that by using it he did not mean "anything more than 'out of bounds,' i. e., plowing in a field that belongs more properly to another" which is *eine ganz andere Sache*.

In the face of Professor Small's statement, Professor Baldwin is, of course, left to take the whole responsibility for the offensive construction which he has placed upon the word of his colleague. That is what he has done in the 'Correction' published in the March number of the *Psychological Review*. It is to be remarked, however, that the terms of this 'Correction' are strikingly ambiguous. The reader might be led to believe that Professor Small considers Baldwin's mistake in the interpretation of his word, 'immaterial.' As a matter of fact, as shown by Professor Small's letter, he refers very distinctly the 'immateriality' of the mistake, not to the use of the word, but to its source, which is, again, *eine ganz andere Sache*.

What remains, after this, is a clear implication of plagiarism against Professor Giddings.

Let us say, once for all, that Professor Baldwin can lay no claim whatever to the discovery that has changed our view of social life by lending a definite support of facts to the psychic conception of social relations. The discovery is that of 'imitation' by Tarde. In spite of Professor Baldwin's futile attempt to minimize Tarde's merit by associating the name of the latter with that of Bagehot, Tarde is and will always be, for every unprejudiced student, the discoverer of imitation as a great psychological force underlying both social and mental development. Bagehot only gave us vague hints and tentative guesses. Tarde gave us the clear notion of the elementary social fact, the unit of social investigation. Professor Baldwin has undoubtedly the merit of

having diligently and industriously followed the path shown by the French master, of having seized his original intuition and carried it into his own psychological field as a vivifying ferment of research. An important contribution of Professor Baldwin to knowledge is the genetic study of imitation as the typical form of organic and mental accommodation to environment, as the method through which the mental development of the individual is accomplished. But, beyond this distinctly psychological work, mainly embodied in his volume on 'Mental Development in the Child and the Race,' Professor Baldwin has never brought to light any fact in the line of social evolution that had not been previously intimated or actually mentioned by Tarde. His 'Social and Ethical Interpretations' is undoubtedly an extremely interesting work. But, apart from the 'Dialectic of Personal Growth' which is practically a chapter belonging to the earlier volume, the remainder of the book is substantially a transcription of Tarde in another key. This can be conclusively shown by actual comparison of certain chapters and passages of Professor Baldwin's book with Tarde's 'Les Lois de l'Imitation' and, especially, 'La Logique Sociale.' Even the distinction between the *matter* or content of social organization and its *functional method* or process, so much emphasized by Professor Baldwin, is his own only in so far as the scholastic turn of the formula is concerned. Apart from the Aristotelian terminology adopted by Baldwin, the distinction had been clearly made by Tarde long ago. We must say, furthermore, that, while Professor Baldwin limits the social matter to *thoughts* or intellectual states—a conception justly criticized by Professor Giddings as insufficient and incomplete, Tarde showed the contents of social organization to be not only thoughts, but feelings—*croyances et désirs*—not thought merely nor feeling merely, but a combination of the two, a view which, as Professor Giddings remarks, is 'most consistent both with evolutionary hypotheses and with psychological conclusions' ('Democracy and Empire,' p. 39). This, of course, is not intended to underrate in any way the value of Professor

Baldwin's work. The advancement of science is not only promoted by the discovery of new facts, but also by the verification and propagation of other men's discoveries. Professor Baldwin belongs to the latter class of scientists. His book on 'Social Interpretations,' while bringing forward no new facts, has just the great merit of having helped to propagate the substance of Tarde's doctrines. This work of vulgarization has been so thorough and painstaking as to justify the statement that Professor Baldwin's book is one of the most important contributions of American thought to the advancement of social science.

Since, however, Professor Baldwin has no claim to any discovery in the field of sociology, it becomes interesting to see how he can prove that Professor Giddings—a sociologist—has 'poached' upon his preserves.

The evidence brought forward by Professor Baldwin in support of his charge of dishonesty against Professor Giddings consists:

1. Of a reference to Professor Small's review of Giddings' 'Elements.' This is ruled out because Professor Small himself has distinctly repudiated the interpretation placed upon his word 'poaching,' and moreover because in the passage of his review quoted by Baldwin, Professor Small explicitly acknowledges that Baldwin's 'ejective stage' is one thing and Giddings' 'ejective interpretation' is another thing. In the face of Professor Small's statement, the whole question becomes one of due credit rendered for the term and the concept 'eject.' These, as all well-informed students of psychology know, originated, not with Professor Baldwin, but with the lamented William Kingdon Clifford, and to Clifford, as shown by Professor Giddings' essay on 'The Psychology of Society,' credit was given in the most explicit manner.

2. Of a specific fact mentioned in the following passage of his article (p. 69, footnote):

"To cite a case, besides those pointed out by Professor Small * * * Appendix D in my book may be referred to as putting in my way certain things that Professor Giddings puts in his own way in the SCIENCE article. Even certain of my terms (as Professor Caldwell

also notices), such as 'socius,' 'organic' and 'reflective' sympathy, are used with no intimation of their origin.

'My terms,' Professor Baldwin calls 'socius,' 'organic' and 'reflective sympathy.' We do not suppose that he claims to have coined the word 'socius,' while the specific concept to which Professor Giddings has attached it, if we understand his language, he repudiates. The terms 'organic' and 'reflective' sympathy might conceivably be claimed as inventions in technical nomenclature. But on page 220 of Professor Baldwin's 'Social and Ethical Interpretations' we find the following quit claim:

"Psychologists are generally agreed in finding a distinction necessary between 'organic' and 'reflective' sympathy, similar to the distinction which has been made in considering modesty."

But terms are, of course, minor matters. Let us turn at once to the pure essence of Appendix D. Here it is:

"Whenever the situation depicted by Adam Smith's 'Illustration' was realized—cases involving the sight of both an aggressor and an aggressee with their respective claims upon the onlooker B for sympathy—the creature whose shape, movements, postures, cries, etc., *were like those of B* would be the one which would supply B's copy-system and the one with which his cooperations would arise; that is *the animal of the same kind*. So subjective sympathy would at once be a 'consciousness of kind' and the objective reactions would be indicative of 'kind.'"

The quality of Professor Giddings' dishonesty is now revealed. In a review of Professor Baldwin's book Professor Giddings has put in 'his way' certain things that Professor Baldwin had put in 'his way' in Appendix D, and Professor Baldwin's way—in Appendix D—consists in putting quotation marks about Giddings' way.

In conclusion I would repeat with Professor Small 'there is glory enough to go round.' This means that it is not necessary to vilify other scientists' efforts and work in order to raise the value of one's own contributions. If Professor Baldwin would only remember what

he owes to M. Tarde he would certainly hesitate to accuse others of plagiarism.

NEW YORK CITY.

GUSTAVO TOSTI.

CARNEGIE INSTITUTION.

THE Advisory Committee in Astronomy will be glad to receive information or suggestions, regarding investigations in astronomy which should be aided by the Carnegie Institution. It is advisable that applications should be made as soon as possible. They may be addressed to the Chairman of the Committee, Cambridge, Mass.

EDWARD C. PICKERING, *Chairman*.

LEWIS BOSS.

GEORGE E. HALE, *Secretary*.

S. P. LANGLEY.

SIMON NEWCOMB.

CAMBRIDGE, March 29, 1902.

SHORTER ARTICLES.

DISCHARGE FROM HOT PLATINUM WIRES.

DURING the past year I have been investigating the discharge from a hot platinum wire, and the results of this work may, perhaps, be of interest to others. An article has been recently published by Rutherford* on the same subject, in which he determined the velocity of the positive ions and showed that at higher temperatures their average velocity was less than at lower. My own work was intended to compare the velocities of the positive and negative ions and to explain as far as possible the decrease in the velocity at higher temperatures.

By a method similar to one which I had previously used in studying the discharge from a flame† it was shown that the average velocity of the positive ions is greater than that of the negative. By a method similar to one used by Zeleny‡ it was shown that the most rapidly moving positive ions have a greater velocity than the most rapidly moving negative ones. By a modification of this method it was shown that the most slowly moving positive ions given off at lower temperature move comparatively rapidly, but that at higher temperatures some are sent off which

* SCIENCE, 14, 590, and *Phys. Rev.*, 13, 321.

† *Phys. Rev.*, 12, 65.

‡ *Phil. Trans. Roy. Soc. Lond.*, 195, 193.

are fully as slow as any of the negative ones.

At higher temperatures the air is ionized to more than molecular distances from the wire.

When the air was enclosed within a tube the rate of discharge became very small. Apparently particles are driven off from the wire at the higher temperatures which are suspended in the air within the tube. These collect on the ions and greatly retard their velocity. These particles do not aid in the discharge, but materially diminish it. Their presence may also be shown by their acting as nuclei in the condensation of water vapor.

These particles are found to be attracted more by the negative ions drawn from a flame than by the positive. It is, therefore, probable that they cause the negative ions in the discharge from the wires to have a smaller velocity than the positive.

Their presence is also shown when the wire is heated in hydrogen, although to a smaller extent. It therefore seems probable that they are particles of platinum, and not of an oxide of platinum.

When the wire is first heated in a vacuum, the discharge is much larger than at any time afterwards. Heating the wire in hydrogen largely restores to it the power of producing discharge. At least some of the discharge would therefore appear to be caused by occluded hydrogen.

The rate of discharge in a vacuum is much larger than in air, but it was found to be impracticable to find the velocity of the ions in a vacuum.

A complete account of the work will be given soon in the *Physical Review*.

C. D. CHILD.

PALEONTOLOGICAL NOTES.

NORTH AMERICAN ELEPHANTIDS.

ANY one who has had occasion to study either the elephants or mastodons of North America needs not to be told that the species of each are very indefinitely known and, for the most part, very imperfectly characterized. Most of the species are based on teeth, one or two on a single tooth, or at the best the

description includes fragments of the jaw. Specimens which have been gradually accumulating in the U. S. National Museum make it possible to at least commence the revision of the species of our elephants, while the material that has been gathered by the field parties of the American Museum of Natural History will throw much more light on the subject.

Of true elephants there appear to be three good species, *Elephas primigenius*, *E. columbi* and *E. imperator*. The first-named, the northern mammoth, a species of moderate size, having teeth with narrow enamel bands, seems to have ranged from Alaska southeasterly to about the latitude of Washington, D. C.

A line drawn from Washington to St. Louis and thence northwestward to Victoria, B. C., would roughly mark the southern boundary of its habitat. To the south of this line, extending to Florida and to the city of Mexico, is found *Elephas columbi*, a much larger animal on the average than the northern species, having teeth with coarser enamel bands. There seems to be an overlapping of the two species, especially in the northwestern United States, as noted by Professor Cope, and along this line it is difficult at times, if not impossible, to tell from which of the two species individual teeth have come. Fully grown examples of this species must have attained a height of thirteen feet.

Elephas imperator was based by Leidy on an imperfect upper molar from the valley of the Niobrara distinguished by its great size and extreme coarseness of structure. This specimen long remained unique and was finally considered by Leidy to be the same as *E. americanus* or, more correctly, *E. columbi*, since the former name is unusable, being a synonym. Last fall, however, Mr. W. H. Holmes obtained in Indian Territory a considerable number of teeth of both *Elephas* and *Mastodon* from the same spot, comprising molars of *M. americanus*, *E. columbi* and some referable to Leidy's *E. imperator*. Teeth of this species may be distinguished from similar teeth of *E. columbi* by their coarse structure, the large amount of cement and the small number of enamel plates. Thus

an upper molar of *E. imperator* has 17 cross ridges and one of *E. columbi* 21 or 22, while the number of ridges in the lower molars are respectively 18 and 22, this last being an estimate owing to the lack of a perfect specimen for comparison. In each case the molars of *E. columbi* are smaller. Thus Leidy's species may be considered as definitely established.

The mastodons are, as species go, in a badly mixed condition, and even the status of the abundant and widely distributed *Mastodon americanus* is by no means so well defined as one could wish. The last molar of this species varies enormously not only in size, but in proportions and character of the enamel, and while the typical last molar has four cross crests and a heel, there may be four cross crests only, or five cross crests and a heel. Moreover, while the enamel is usually quite smooth, it is often more or less rugose, in some instances being decidedly wrinkled, and *M. rugosidens* of Leidy is undoubtedly based upon a tooth of this character. A fine series of teeth obtained by Mr. W. H. Holmes at Afton, Ind. Terr., shows the great range of variation in the teeth of *M. americanus*.

M. shepardi, once called *obscurus*, from California, is a good species, characterized by a small narrow last molar and by the partial interruption of the valleys on one side. The true *Mastodon obscurus* is a species founded by Leidy on an imperfect last molar from North Carolina, described and figured on plate XXVII., figure 16, of the Extinct Mammalian Fauna of Dakota and Nebraska. This species is so far definitely known from our eastern coast from Florida to Maryland, and the specimens described as *M. floridanus* must be known as *M. obscurus*. The writer pleads guilty to having overlooked this when editing Dr. Leidy's posthumous paper on fossil vertebrates from the Alachua Clays. It is probable that *M. serridens* of Cope is a slightly aberrant fifth molar of *M. obscurus*, although it was decided otherwise in the memoir just referred to. Dr. Leidy was perhaps over-cautious in making new species, and described no less than three mastodons under the name of *obscurus*. As an offset to this it may be

said that there is reason to believe that Professor Cope went to the opposite extreme of describing one species under three names.

Mastodon mirificus, with a last molar having six much-wrinkled cross crests, is another well-defined species, but there are several others that are not at present well defined. Among these is *M. proavus* of Cope, which he doubtfully separated from *M. angustidens*, and may prove to be the same as *M. obscurus* (= *floridanus*) of Leidy. The writer has never seen a tooth of mastodon from an American locality that was not readily distinguishable from the European *M. angustidens*, and he ventures to doubt the occurrence of this species in North America.

M. productus Cope is another dubious species and so is *M. tropicus*, whose teeth as figured by Cope are indistinguishable from those of *M. obscurus*, while the figure of *M. proavus* strongly suggests the true *M. shepardi*. That one tooth has one more cross crest than the other and is more pointed at the heel means little, as just such differences are known to exist in the last molars of *M. americanus*, while the last molars of various mastodons appear to be exceedingly variable.

The identification of the species of mastodons from scattered teeth is, if not impossible, at least extremely difficult, while the attempt to identify species from figures is equally unsatisfactory. Another question on which light is needed is whether the presence of lower tusks and a long symphysis to the lower jaw is a specific or sexual character, or whether it may not be specific in some cases and merely indicative of sex in others? There are certainly specimens of mastodon jaws with and without tusks whose molars are indistinguishable. It is to be hoped that the time is not far distant when we may have sufficient good material to place our species of mastodons on a satisfactory basis.

F. A. L.

CURRENT NOTES ON METEOROLOGY.

THE DUST STORM OF MARCH 9-12, 1901.

THE remarkable fall of dust which occurred over Europe about a year ago has been noted in numerous short articles in various scien-

tific journals, but there has until very recently been no extended report upon it. Hellmann and Meinardus, of the Prussian Meteorological Institute in Berlin, have just issued an elaborate monograph on this subject, with the title 'Der Grosse Staubfall vom 9 bis 12 März, 1901, in Nordafrika, süd und Mitteleuropa (Abhandl. K. Preuss. Met. Inst., II., 1). The region over which the dust fell extended from the desert of southern Algeria north to southern Denmark, *i. e.*, over a distance of more than 25° of latitude. There were dust storms in southern Algeria on March 8-10; and as the dust was carried northward it fell in Italy and Sicily on March 10; over the eastern Alps on the night of March 10-11; in central Germany on the forenoon of the 11th; in northwestern Germany on the afternoon and evening of the 11th and in southern Denmark on the night of the 11th-12th. In Algeria and Tunis the fall was of dust; in Italy there was a fall of dust during a dry stormy sirocco, and rain heavily charged with dust also fell. In Austria-Hungary and farther north the phenomenon was everywhere associated with some form of precipitation (rain, snow, frozen rain, etc.). The amount of dust which fell to the ground decreased from south to north. Microscopical examinations of the deposit collected in various places make it plain that the dust was of terrestrial origin—an æolian deposit resulting from the disintegration of rocks in a desert region. The particles became finer and finer with increasing distance from their source in southern Algeria, and there was noted a decrease in the percentage of quartz from south to north. The northward progression of the dust-fall was associated with the advance of a barometric depression from Tunis in a north-northeast direction to the southern shore of the Baltic Sea, as shown on the daily weather maps, and the pressures at an altitude of 2,500 m. above sea level likewise indicate the presence of a southerly current from Tunis to central Germany. The velocity of this upper current was found to be 70 km. an hour, and the dust-fall itself also progressed northward at the same rate.

The report of Hellmann and Meinardus is illustrated by means of several charts show-

ing the pressures at sea level and at 2,500 m.; the distribution of the dust over Europe; the distribution of precipitation on March 12, at 7 A.M., and the distribution of temperature on March 11 and 12. 'Der Grosse Staubfall' will prove of special interest to geologists and to geographers, as well as to the meteorologists for whom it was primarily written.

METEOROLOGICAL CHART OF THE GREAT LAKES.

THE 'Meteorological Chart of the Great Lakes, Summary for the Season of 1901,' by A. J. Henry and N. B. Conger (U. S. Weather Bureau), presents a number of interesting facts concerning the meteorology of these important bodies of water. The navigation season of 1901 brought a record of 37 total losses of vessels from weather conditions, and 11 from other causes. In addition, 140 vessels were more or less damaged by weather conditions, and of these, 34 cases were due directly to fog. The total number of lives lost through stormy weather was 90. Monthly and annual normal fog charts are published with the present bulletin, embodying the results of four years of fog observations. More fog is encountered on Lake Superior than elsewhere, and the conditions of fog formation are better understood there. On Lake Michigan some of the fogs form in the summer a short distance out from shore during early morning, and dissolve under the increasing warmth of the sun's rays. The early morning land and lake breezes often cause banks of fog to form, sometimes as low-lying fog, and at other times as dense banks, with frequent openings of clear weather. In autumn, when cyclones move in from the southwest, a blanket of fog appears, and may last one, two or three days, with only an occasional clearing.

THE SEISMOGRAPH AS A SENSITIVE BAROMETER.

IN a recent number of the *Quarterly Journal of the Royal Meteorological Society* (Vol. XXVII., 1901, 293-298) there is a paper on 'The Seismograph as a Sensitive Barometer,' by Mr. F. Napier Denison, of Victoria, B. C.

A Milne seismograph was installed in 1898 at the Meteorological Office, Victoria, and the

author has since that time compared its movements with the changes of atmospheric pressure recorded by his aerograph. He finds that when the barometric pressure is high over the Pacific slope from British Columbia southward to California, while off the Pacific coast the barometer is comparatively low, the horizontal pendulum of the seismograph tends to move towards the eastward. When an extensive storm area is approaching from the westward, and often eighteen to twenty-four hours before the local barometer begins to fall, the pendulum of the seismograph swings steadily to the eastward, and in the event of a well-marked high area following, the pendulum will begin to swing towards the westward before it is possible to ascertain this area's position on the current weather charts.

R. DEC. WARD.

HARVARD UNIVERSITY.

SCIENTIFIC NOTES AND NEWS.

THE National Academy of Sciences will hold its annual stated session at Washington, beginning on April 15.

PROFESSOR F. B. CROCKER has been elected chairman of the executive committee to arrange for the reception in honor of Lord Kelvin, which will be given at Columbia University on the evening of April 21.

THE University of Wales will confer its doctorate of science on Lord Kelvin, Lord Lister and Mr. Alfred Russel Wallace.

M. YERMOLOFF has been elected a correspondent of the Paris Academy of Sciences in the section of agriculture, in the room of the late Sir John Bennet Lawes. M. Baillaud has been elected correspondent in the section of astronomy.

DR. EWALD HERING, professor of physiology in the Medical School at Leipzig, has been elected a corresponding member of the Munich Academy of Sciences.

At the annual general meeting of the Geological Society of London, on February 21, the president, Mr. J. J. H. Teall, F.R.S., presented the balance of the proceeds of the Lyell

Geological Fund to Dr. Wheelton Hind, F.R.C.S., of Stoke-on-Trent, stating that the council of the Society had made the award as a mark of their appreciation of his enthusiastic labors among the carboniferous rocks of this country.

DR. THEODORE PAUL, professor of chemistry in the University at Tübingen, has been called to the directorship of the Imperial Board of Health at Berlin.

M. SAVORGNAN DE BRAZZA, the Italian explorer in the service of the French Government, has been granted a pension of 10,000 francs.

DR. S. WEIR MITCHELL, who has for over thirty years been associated with the Philadelphia Orthopedic Hospital and Infirmary for Nervous Diseases, has resigned as senior physician, but remains as one of the consultants. Dr. John K. Mitchell has been elected to the vacancy caused by his father's withdrawal.

It is said that the Hon. Andrew D. White will retire from the ambassadorship to Germany in November.

A COMMITTEE has been formed, under the presidency of Professor von Zittel, for the erection in Munich of a memorial of the late Professor Max von Pettenkofer.

PROFESSOR ALBERT RIPLEY LEEDS, since 1871 professor of chemistry in the Stevens Institute of Technology, died on March 14 at the age of fifty-eight years.

DR. JOHANNES CHRISTOPH KLINGE, head botanist of the Botanical Gardens at St. Petersburg, has died at the age of fifty-one years.

THE death is announced from St. Petersburg of Major-General Pewzoff, known for his explorations in Central Asia, Mongolia and Tibet.

At a meeting of chemistry teachers held at the Hotel Albert, N. Y., March 20, the Chemistry Teachers' Club was organized. A constitution was adopted, and the following officers were elected: A. C. Hale, *President*; R. H. Fuller, *Vice-President*; A. L. Arey, *Treasurer*; M. D. Sohon (Peter Cooper High School), *Secretary*.

AFTER paying all the expenses of the last international medical congress, a surplus of about 40,000 francs is left. The committee expect to apply this sum as an endowment of a triennial prize to be awarded at future congresses.

LORD WALSHINGHAM has given to the British Museum (Natural History) his collection of butterflies and moths. This collection of microlepidoptera contains over 200,000 specimens, and is probably the largest and most valuable in the world. It includes the Zeller, Hoffman, Christoph and other collections, and contains many type specimens. Lord Walsingham has himself published numerous monographs on the microlepidoptera.

THE University of Cincinnati has ordered for its observatory a refracting telescope, with an objective of 16 inches, from the Alvan Clark & Sons Corporation. The observatory at Cincinnati, established in 1842, is one of the oldest in the country, and has during the last twenty years been under the direction of Professor J. G. Porter.

THE magnetic observatory at Nice was compelled to remove to Mount Mounier, owing to interference by the electric trolley car system, and is suing the company for \$20,000, the cost of removal.

COMMISSIONER GEORGE M. BOWERS has selected a plot of thirty acres of land near Tupelo, Miss., for a new Government fish hatchery.

PROFESSOR C. B. DAVENPORT and Dr. H. C. Cowles, of the University of Chicago; Professor W. S. Leathers, of the University of Mississippi, and a number of graduate students of the University of Chicago visited Mississippi Sound from March 15 to 31. Making its headquarters at Biloxi, Miss., the party worked on the mainland on Deer, Ship, Cat, Horn and Chandeleur Islands and in the Sound. Special studies in ecology, variation and geographical distribution were made.

THE following are among the lecture arrangements at the Royal Institution, after Easter: Dr. Allan Macfadyen, three lectures on 'Recent Methods and Results in Biological

Inquiry'; Professor Karl Pearson, three lectures on the 'Laws of Heredity, with Special Reference to Man' (the Tyndall lectures); Professor Dewar, three lectures on the 'Oxygen Group of Elements'; Dr. A. Smith Woodward, three lectures on 'Recent Geological Discoveries.' The Friday evening meetings will begin on April 11, when Professor Dewar will deliver a discourse on 'Problems of the Atmosphere.' Succeeding Friday evening discourses will be delivered by Sir John H. A. Macdonald, Dr. J. Mackenzie Davidson, Sir Robert Ball, Sir Benjamin Baker, Professor A. E. Tutton and others.

DR. L. A. BAUER will give the following illustrated series of lectures on 'Terrestrial Magnetism' at the Johns Hopkins University from 5 to 6 P.M.:

April 28—'The Principal Phenomena of the Earth's Magnetism.'

April 29—'The Instruments and Methods of Magnetic Surveys.'

April 30—'The Objects and Results of Magnetic Surveys.'

May 1—'The Present Status of the Theory of the Earth's Magnetism.'

THE annual meeting of the German Public Health Association will be held this year in Munich from September 17 to 20. The following questions are proposed for discussion: (1) The Hygienic Supervision of Water-courses; (2) Town and Country in their Sanitary Relations and the Sanitation of Rural Districts; (3) Damp Dwellings: Cause, Influence on Health, and Measures for Amelioration; (4) Influence of Quackery on the Health and Life of the Population; (5) The Baking Trade from a Hygienic Standpoint in regard both to Trade and the Consumer.

THE Peary Arctic Club's steam barque *Windward* has arrived at New York from Brigus, N. F., where it has been wintering since its return from the Arctic last September. The vessel is to have new engines and boilers installed. It will return to the Arctic regions this summer for Lieutenant Peary.

THE London *Times* prints some details regarding the French hydrographic expedi-

tion to Indo-China under Lieutenant Hevond. It has begun its labors in the Siamese Peninsula by preparing maps of the bay of Kampong Som and the gulf of Ha Tien. On the completion of this work the ship will return to the eastern coast of Indo-China, where it will remain a month, in order to give the mission time to verify the plans of the mouths of the Mekong. The expedition will then carefully reconnoitre the whole coast of Anam, a work the duration of which it is impossible to estimate, and will subsequently spend several months in Tongking. The rest of the time will be devoted to verifying the results previously reached. Besides its work of preparing maps, the expedition will aim at gathering all general geographical information of interest.

THE House committee on interstate and foreign commerce has voted to report the Hepburn Pure-Food bill to prevent the adulteration, misbranding, and imitation of foods, beverages, drugs, etc., and regulating interstate traffic in such goods. The bill was framed by the National Pure-Food Congress.

THE bill appropriating \$10,000 for experimenting on the destruction of mosquitoes in New Jersey has been defeated in the senate by a vote of 8 to 10.

WE learn from the *British Medical Journal* that it is reported that Professor Emil v. Behring (Marburg) will give the amount of the Nobel prize recently awarded him (\$40,000) to the Prussian State for the permanent endowment of the Institute of Experimental Therapeutics founded by him in the University of Marburg. The gift is to be devoted to the prosecution on a large scale of the researches on serum initiated by Professor Behring. The fact may appropriately be recalled that several years ago Professor von Behring gave the half of a French prize awarded to him, equivalent to a sum of \$5,000, in furtherance of serum research.

THE report of progress of stream measurements for the calendar year 1899, by Mr. F. H. Newell, with the two accompanying papers noted below, has been issued as Part IV. of the Twenty-first Annual Report of the United

States Geological Survey. The whole makes a volume of 768 pages, illustrated by 156 plates and 329 figures, including views of rivers and the methods of measuring them, with maps and diagrams of river flow. In the report of progress, tables of maximum, minimum, and mean discharge of streams in various parts of the United States are given, and other data of use to engineers and investors, as well as to the public in general. Following the report of progress of stream measurements is a paper by Mr. N. H. Darton, giving a preliminary description of the geology and resources of the southern half of the Black Hills and adjoining regions in South Dakota and Wyoming. The volume closes with a paper by Mr. Willard D. Johnson on the 'High Plains and their Utilization,' giving a description of the structure of the Great Plains region of western Kansas and adjacent states, and discussing the occurrence of water under ground.

THE *London Times* states that at the last meeting of the council of the Royal Geographical Society it was decided to recommend Sir F. D. Lugard and Major Molesworth Sykes, as recipients of the two Royal medals for the present year. Since 1888 Sir Frederick Lugard has served in tropical Africa, first in Nyasaland, next in what is now British East Africa, then in Uganda, and since then in Ngami Land and in Northern Nigeria, where he now holds the position of high commissioner. During the fourteen years of his African service in countries very little known, he has always devoted much personal attention to the geography of the districts through which he passed, making maps and plans. Major Sykes has been awarded the medal for his journeys in Persia, extending over nine years. Many thousands of square miles of good mapping have been obtained by his political assistance, independently of the large area for the geography of which he has been personally responsible. The other awards of the Society have been made as follows: The Murchison grant to Mr. J. Stanley Gardiner, for his researches in Funafuti Island in the Pacific, and the Maldive Islands in the Indian Ocean; the Gill memo-

rial to Mr. G. G. Chisholm, for the services he has rendered during twenty-five years to geographical education by text-books of various kinds, atlases, and lectures, all of a high standard of value, as well as for his geographical investigations, among other subjects into cataracts and waterfalls, and on the sites of towns; the Back grant to Lieutenant Amdrup, of the Danish navy, for his two voyages of exploration to the east coast of Greenland, during which he surveyed and mapped in detail much of the coast hitherto unknown or imperfectly mapped; the Peek award to Mr. J. P. Thomson, the founder of the Queensland branch of the Australian Geographical Society, who, by his writings and in other ways, has done much to promote the interests of geography in Queensland.

UNIVERSITY AND EDUCATIONAL NEWS.

HARVARD UNIVERSITY has received three large bequests: \$450,000 from the late George Smith, of the class of '53, to be used in erecting three dormitories; \$100,000 without restriction from the late Robert C. Billings, of Jamaica Plain, and \$100,000 from the late Jacob Wheelock, of Worcester, Mass. Mr. Wheelock also bequeathed \$100,000 to Clark University, and Mr. Billings bequeathed \$100,000 each to the Massachusetts Institute of Technology and the Boston Museum of Fine Arts.

BARNARD COLLEGE, Columbia University, has added \$500,000 to its endowment, one half having been given by Mr. John D. Rockefeller and the other half having been collected as a condition of this gift.

By the will of George L. Littlefield, of Providence, Brown University receives \$100,000 for the establishment of a chair of American history and the residue of the estate, which, it is said, may amount to \$500,000.

By the will of Mrs. S. P. Lees, of New York, Washington and Lee University receives a bequest of \$30,000.

SIR WILLIAM McDONALD has given McGill University \$20,000 for the purchase of books needed for the research work of students in arts, and has also presented to the physics

building a liquid-air plant, and to the zoological department equipment for the teaching of embryology.

THE class of '76 at Yale University has established with \$5,000 a scholarship, named in honor of President Hadley, who was a member of the class.

OTHER gifts to educational institutions include \$20,000 to Carroll College, in Wisconsin, from Mr. Ralph Vorhees, and \$5,000 to the Stevens Institute of Technology from Mr. Alexander C. Humphreys.

WE are informed that the Science Hall at the University of Montana was only partially burned on March 14, the loss falling almost entirely upon the engineering department. The foundry, forge room, machine shop and the assay laboratory in chemistry were gutted. The loss is about \$6,000, fully insured. The other laboratories were not injured. The burned portion will be immediately rebuilt. The origin of the fire is unknown.

THE troubles in the Russian universities and other institutions of learning seem to be very serious. It is said that the University of St. Petersburg will not be open until the autumn, and perhaps not then. In a technical school at Plock the students set fire to the building and attempted to lynch the professors. About one hundred students of Moscow University have been banished to Siberia and about 500 have been imprisoned.

THE Carnegie Trust of the Universities of Scotland has prepared its first report. No appropriations have as yet been made for research or the improvement of the facilities of the universities. But in accordance with Mr. Carnegie's wishes, the fees of a large number of students have been paid, the number at each of the four universities and the amount of the fees being as follows: St. Andrew's, 268 students, class fees, £2,452 16s.; Glasgow, 828 students, class fees, £7,672 13s. 6d.; Aberdeen, 473 students, class fees, £3,806 1s. 6d.; Edinburgh, 872 students, class fees, £9,010 5s. 6d.

MISS ELEANOR MARIE NAST has been awarded by the Woman's College of Baltimore a foreign fellowship in biology.